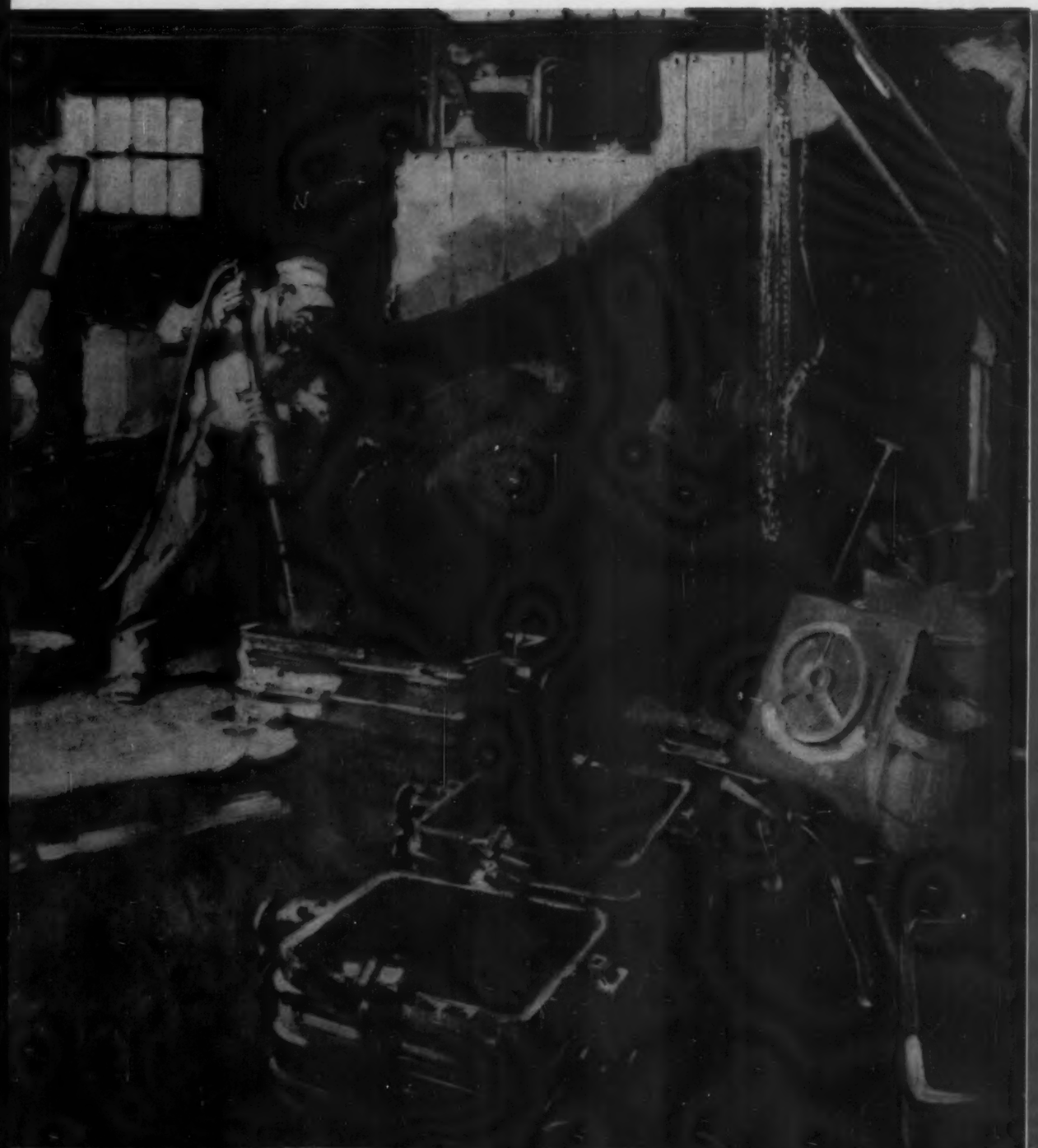
OCTOBER, 1956

modern castings



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THE MEN WHO BUY

CORE BLOWING
16-page special bonus section with 28 illustrations describes history, machines, components and principles of core blowing

Decarburization
The how and why of a very common problem—and what to do about it

Before You Buy . . .
. . . Consult the man responsible for operating the new equipment

Accounting for Quality
Here's a record system that will help control quality by statistics

New Die Casting Plant
Doehler-Jarvis anchors machines on tracks for quick change-over

Quench-Aging Malleable
Phenomenon increases hardness and tensile strength of malleable iron

Two New Cupolas
European designs control iron quality by controlling the slag

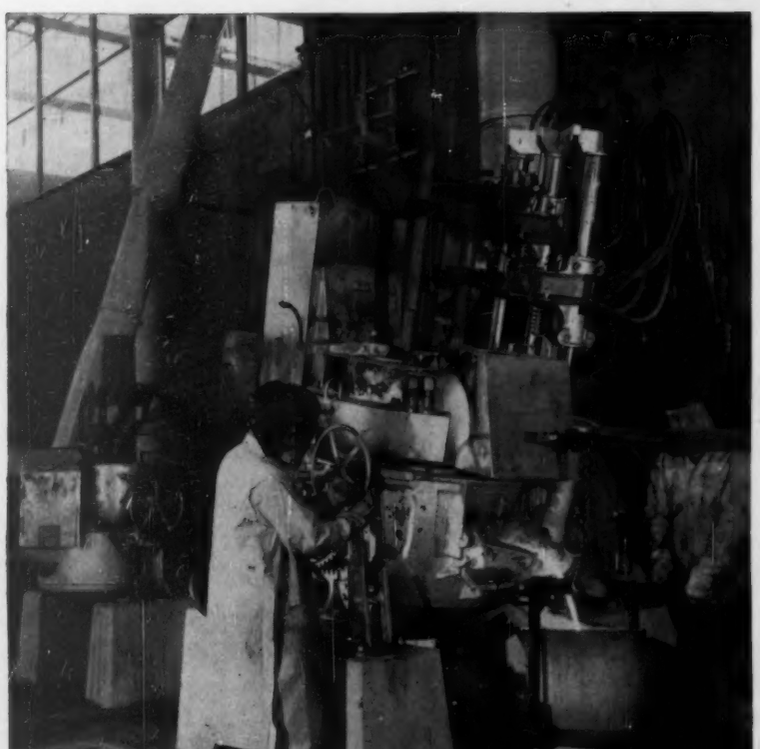
Casting Uranium
Increasing tonnages must be cast into fuel shapes. Here's the story

Steel Wheels in Green Sand
Take a trip with Modern Castings through the Southern Wheel plant

Cover Painting
Foundry scene painted by Terence Cuneo was commissioned by International Nickel Company and exhibited at Grand Central Art Galleries in New York in September

FOUNDRY RESEARCH

includes Lectromelt* Furnaces when building for the future



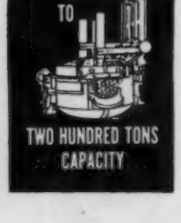
RECOGNIZING the importance of the electric arc furnace to the modern iron and steel foundry, research laboratories now include them for help in developing methods and solving metal problems. The two Lectromelt Furnaces shown above are in such a foundry—small enough to expedite experiments, big enough to simulate production runs.

Lectromelt Furnaces give the exact control of heat and analyses needed to make today's engineered castings. With metallurgical research finding more and more uses for special alloy castings, specifications are tougher, yet a good foundry with a Lectromelt Furnace can meet these rigid requirements.

Our engineers will answer your questions covering all sizes of furnaces. Catalog No. 9-A describes them. For a copy, write Lectromelt Furnace Company, 316 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa . . . JAPAN: Daido Steel Co., Ltd., Nagova

*REG. T. M. U. S. PAT. OFF



WHEN YOU MELT... Lectromelt

CIRCLE NO. 121, PAGE 21-22

future meetings and exhibits

OCTOBER

4-5 . . Magnesium Association, *Drake Hotel, Chicago, Annual Convention.*

6-12 . . American Society for Metals, *Public Auditorium, Cleveland. National Metals Congress & Exposition.*

8-12 . . American Welding Society, *Hotel Cleveland, Cleveland. Fall Technical Meeting.*

10-11 . . Material Handling Institute, Inc., *Traymore Hotel, Atlantic City, N. J. Fall Meeting.*

11-12 . . National Foundry Association, *Sheraton-Cadillac Hotel, Detroit. Annual Meeting.*

11-12 . . Armour Research Foundation, Illinois Institute of Technology, *Hotel Sherman, Chicago. National Noise Abatement Symposium.*

13 . . Metropolitan Brass Founders' Assn., *The Brass Rail, New York. Forty-sixth Anniversary.*

18-20 . . Foundry Equipment Manufacturers' Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

19-20 . . New England Regional Foundry Conference, *Massachusetts Institute of Technology, Cambridge, Mass. Sponsored by the New England and Connecticut Chapters of the American Foundrymen's Society.*

19-20 . . Northwest Regional Foundry Conference, *Benjamin Franklin Hotel, Seattle. Sponsored by the Washington, Oregon, and British Columbia Chapters and the Oregon State College Student Chapter of the American Foundrymen's Society.*

20-23 . . Conveyor Equipment Manufacturer's Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

22-26 . . National Safety Council, *Conrad Hilton, Congress, Morrison, and LaSalle Hotels, Chicago. Safety Congress & Exposition.*

25-26 . . Metals Casting Conference, *Purdue University, Lafayette, Ind. Sponsored by the Central Indiana and Michigan Chapters and the Purdue University Student Chapter of the American Foundrymen's Society.*

29-30 . . Refractories Institute, *The Homestead, Hot Springs, Va. Fall Meeting.*

31-Nov. 2 . . Gray Iron Founders' Socie-

ty, *The Homestead, Hot Springs, Va. Annual Meeting.*

31-Nov. 2 . . Industrial Management Society, *Hotel Sherman, Chicago. Time and Motion Study and Management Clinic.*

NOVEMBER

7-9 . . Steel Founders' Society of America, *Carter Hotel, Cleveland. Technical & Operating Conference.*

8-9 . . All-Canadian Foundry Conference, *Mount Royal Hotel, Montreal, Que. Sponsored by Eastern Canada and Ontario Chapters of the American Foundrymen's Society.*

25-30 . . American Society of Mechanical Engineers, *Hotel Statler, New York. Annual Meeting.*

26-30 . . Third International Automation Exposition, *Trade Show Bldg., New York.*

29-30 . . Michigan Regional Foundry Conference, *University of Michigan, Union Bldg., Ann Arbor, Mich. Sponsored by the Detroit, Saginaw Valley, Central Michigan, and Western Michigan Chapters of the American Foundrymen's Society, and the University of Michigan and Michigan State University Student Chapters.*

DECEMBER

5-7 . . American Institute of Mining and Metallurgical Engineers, *Morrison Hotel, Chicago. Electric Furnace Steel Conference.*

10-11 . . Material Handling Institute, Inc., *Biltmore Hotel, New York. Annual Meeting.*

1957

FEBRUARY

14-15 . . Wisconsin Regional Conference, *Hotel Schroeder, Milwaukee. Sponsored by the Wisconsin Chapter and the University of Wisconsin Student Chapter of the American Foundrymen's Society.*

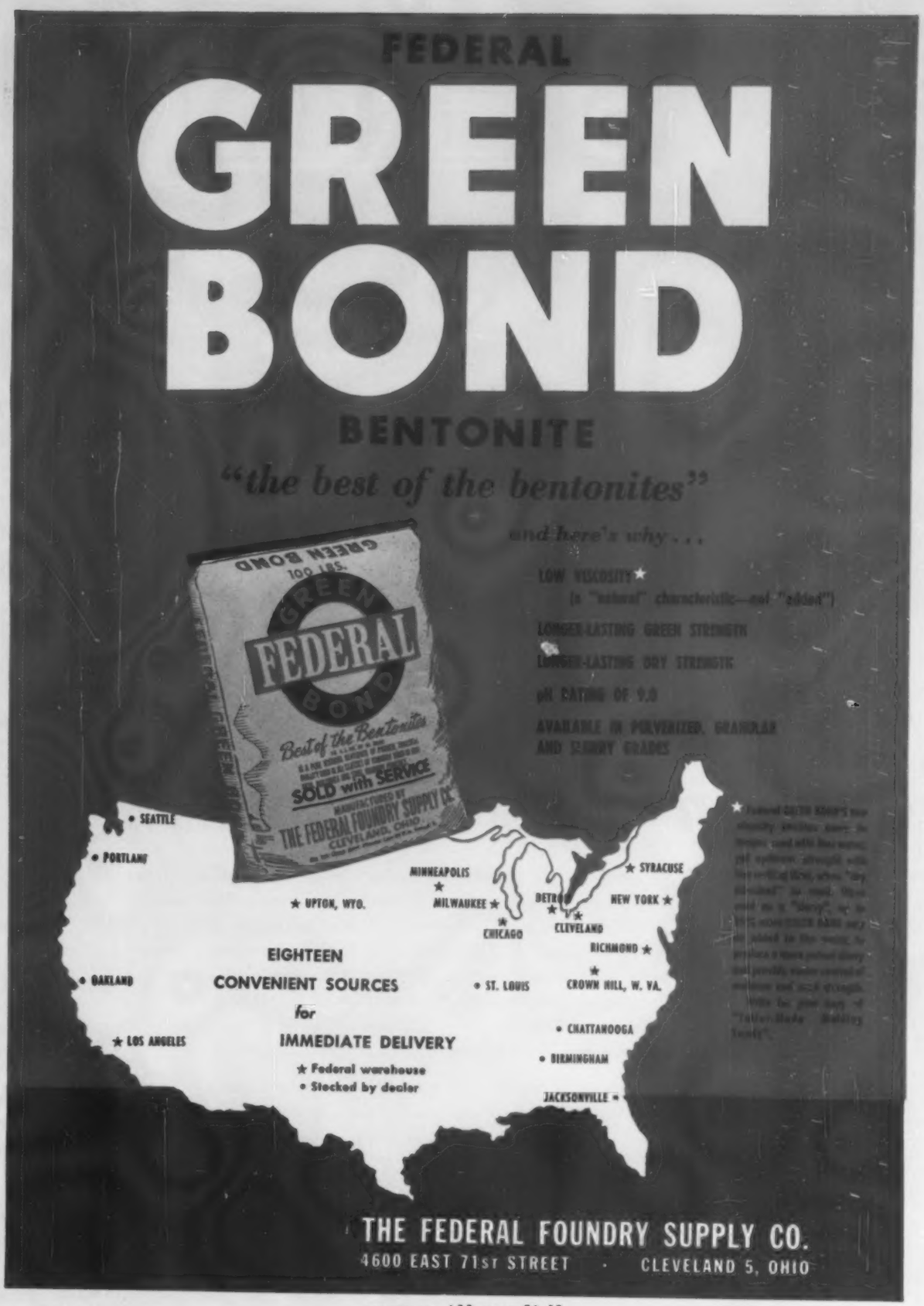
21-22 . . Southeastern Regional Foundry Conference, *Dinkler-Tutwiler Hotel, Birmingham, Ala. Sponsored by the Birmingham and Tennessee Chapters and the University of Alabama Student Chapter of the American Foundrymen's Society.*

MARCH

11-15 . . Nuclear Congress, *Convention Hall, Philadelphia.*

15-16 . . California Regional Foundry Conference, *Claremont Hotel, Berkeley, Calif. Sponsored by the Northern California and Southern California Chapters of the American Foundrymen's Society.*

25-29 . . American Society for Metals, *Pan-Pacific Auditorium, Los Angeles.*



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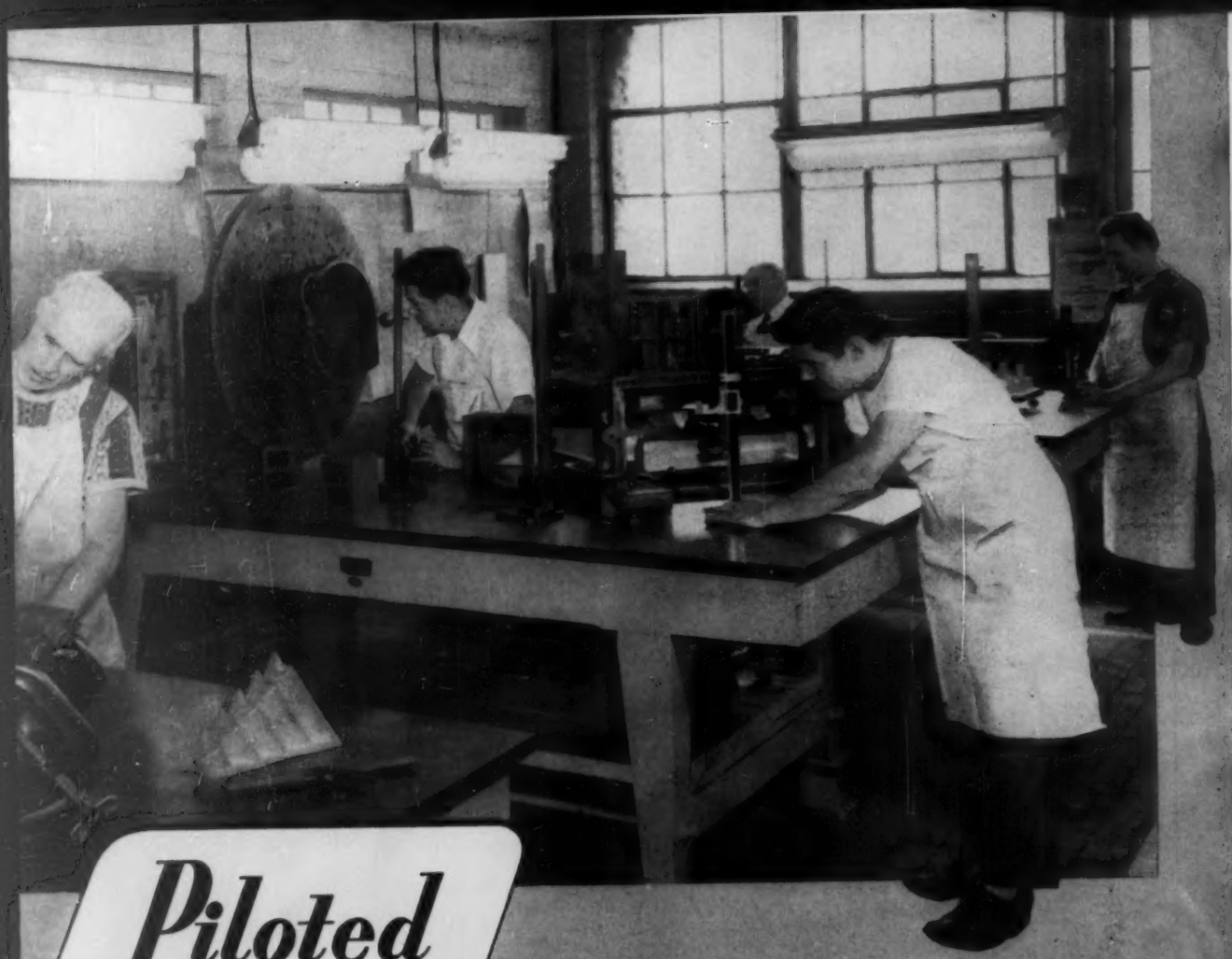

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Translating precision from your blueprints into patterns is the function of our layout and inspection department. Here skilled hands carefully pilot your patterns through every operation performed on them. The latest methods and the finest equipment are used in this important work. Only through such painstaking layout and inspection can unvarying high quality be maintained . . . and it is on such quality that City Pattern Foundry & Machine Company has built its reputation.

"Piloted precision" is another reason why leading manufacturers rely on City Pattern Foundry & Machine Company for the utmost in accuracy, economy and production utility in wood and metal patterns.

ty Pattern Foundry & Machine ompany's Shrinkage Conversion bles save time and eliminate rors in shrinkage calculations. our letterhead request will bring set of these handy tables with- t obligation.

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Tenth Western Metal Exposition and Congress.

APRIL

12-13 . . East Coast Regional Foundry Conference, *Benjamin Franklin Hotel, Philadelphia. Sponsored by the Philadelphia, Metropolitan and Chesapeake Chapters of the American Foundrymen's Society.*

MAY

6-10 . . American Foundrymen's Society, *Cincinnati. Castings Congress.*

JUNE

20-22 . . Penn State Regional Foundry Conference, *Penn State University, State University, Pa. Sponsored by the Rochester, Pittsburgh, Metropolitan, Eastern New York, Western New York, Northwestern Pennsylvania, Central New York, Chesapeake and Philadelphia Chapters and the Penn State University Student Chapter of the American Foundrymen's Society and the Reading Foundrymen's Assn. and Conestoga Foundrymen's Assn.*

23-25 . . Alloy Casting Institute. *The Homestead, Hot Springs, Va. Annual Meeting.*

GIFS Starts Market Plan

An aggressive industry-wide marketing program to sell more gray iron castings has been launched by the newly organized Marketing Committee of the Gray Iron Founders' Society.

Donald H. Workman, G.I.F.S. executive chairman, stated that marketing in the industry has lagged behind its technological advances in that the full possibilities of new techniques had not been exploited. Richard C. Meloy, G.I.F.S. marketing director, said that comprehensive surveys were expected to point ways – such as new product development and better customer service – by which the over-all gray iron castings volume could be increased.

The program will be based on facts to be gathered by comprehensive surveys directed to design engineers, sales executives, purchasing agents, foundries and the public. Results of these surveys will be discussed at regional sales clinics for member foundries.

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october, 1956
vol. 30, no. 4

modern castings

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AUDITED PAID CIRCULATION ABC

On The Management Side

■ Uranium scrap recovery offers a chance for small companies to get into the atomic energy field. Here's the story:

Scrap is being created by a number of companies engaged in reactor fuel fabrication (see pages 32-33). The Atomic Energy Commission does not want to handle this scrap.

The scrap consists of various uranium alloys which can be remelted. A vacuum furnace is needed for remelt. In some cases chemical dissolution, separation and recovery may also be necessary.

"Since the equipment is expected to be small, scrap recovery appears to offer opportunities to those smaller concerns who are seeking a place in the atomic energy picture," an AEC spokesman said.

Such a venture might interest foundries already considering a vacuum remelting furnace.

AEC offers to assist interested companies "by imparting the knowledge and experience we have obtained during the past few years."

■ The Cabinet Committee on Small Business, chairmanned by Dr. Arthur F. Burns, chief economic adviser to the president, has proposed a series of startling recommendations to improve small business welfare.

1. That the taxes imposed on business corporations be reduced from 30 to 20 per cent on income up to $25,000.

2. That businesses buying used property up to $50,000 in value each year be allowed to use formulas for accelerated depreciation made available to purchasers of new property under the Internal Revenue Code of 1954.

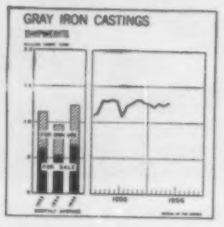
3. That corporations with, say, 10 or fewer stockholders be given the option of being taxed as if they were partnerships.

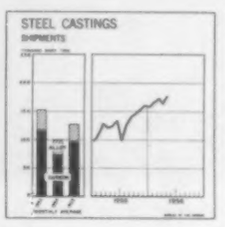
4. That the President call a conference on technical research, development and distribution to aid small business.

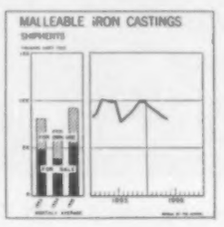
■ For the first half of 1956 shipments of gray iron castings have been holding approximately level, with only a slight decline since September, 1955. Unfilled orders for gray iron castings at the end of May were 16 per cent higher than at the end of May, 1955.

Malleable iron castings showed a decline in shipments since the first of the year. Unfilled orders were also lower.

Shipments of steel castings show an almost steady increase since the middle of 1955. Unfilled orders for steel castings on May 31 were more than 2½ times the unfilled orders of one year before. Accompanying charts show trends of shipments since 1953.





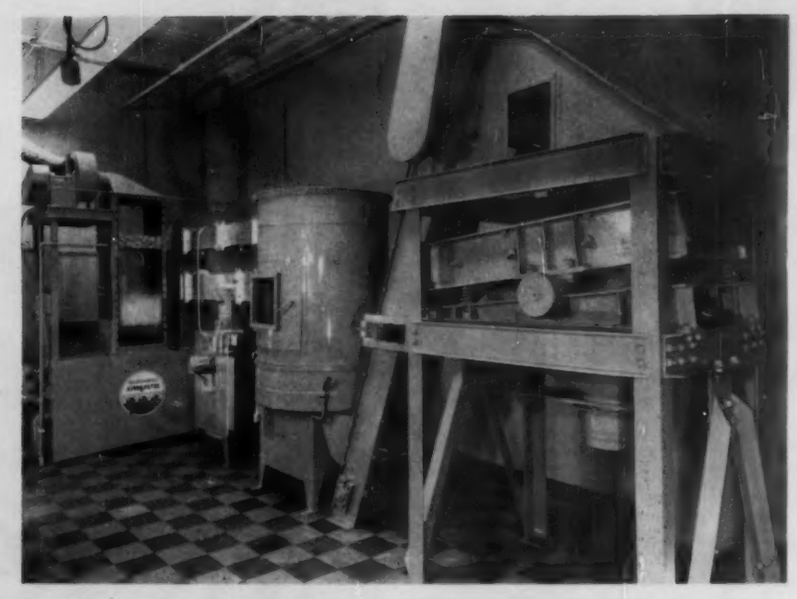


modern castings album

Your stand-in for tests on auto crashes is a nonchalant lad whose neck swivels on an investment cast vertebra. Mark III is a robot test dummy used to collect physical data about what happens to the human system in crashes and accidents too dangerous for human test drivers. In creating Mark, his designers decided that the way to give him a neck that would work like a human one would be to use investment casting and make one to exact medical specifications. As a result, Investment Casting Co., Springfield, N.J., produced a casting that is a perfect replica of the cervical vertebra. The vertebrae fit together in a modified ball and socket and motion is controlled by a boss that projects from the top of one casting and fits into a radial slot in the lower surface of the cast vertebra above.

INTERNATIONAL NICKEL COMPANY PHOTO

Only by casing could Westinghouse make in one piece this 5,095 lb Cr-Ni-Cb stainless casing for a pump to be used in nuclear power plants.



Not one, but two foundry suppliers have opened new laboratories to provide sand testing facilities for foundrymen with questions. On the West Coast, Brumley-Donaldson Company has opened a sand lab at Huntington Park, Calif., while National Engineering Company has established a new service lab at its Chicago headquarters.

In the service laboratory of National Engineering Co. (upper photo) are offered facilities for running test batches of coated sand. Foundry operators are invited to run coating tests using their own sand and resin. Lab equipment is production size and is said to produce 800 to 1200 lb of coated sand hourly. To use the lab, write Shell-Mull, National Eng. Co., 549 W. Washington, Chicago 6, Ill. A sand sample of 600-800 lb shipped in 100 lb bags will be required, plus data on type and percentage of resin, screen size and type sand.

The Brumley-Donaldson labs, (lower photo) at 5955 State St. in Huntington Park, are under the supervision of Frank S. Brewster, past chairman of the Sand Division of AFS. This non-commercial lab is equipped to determine green, dry, and hot properties of core and molding sands. Brumley-Donaldson states that it offers this free service to give foundrymen scientific selection and control of molding materials.

committees in action

Committee of Exhibitors met in Chicago, June 5, with 11 members present. During discussion of "pros" and "cons" of the '56 Show it was emphasized that over 2800 foundries were represented at the Show. The 1957 Castings Congress will be held in Cincinnati, May 6-10, and the '58 Show in Cleveland, starting May 24.

Standing Committee on Chapter Educational Activities met in Cleveland, August 9, with 10 members present. This committee promotes and assists each AFS chapter in the establishment of active educational programs. They are currently assisting chapters to organize education committees, to set up programs for training and up-grading plant personnel, to improve public relations of the industry, and to assist secondary schools.

Mulling Techniques Committee (8-K) met at the University of Wisconsin, August 22-23, with 11 members present. As the result of research by Prof. R. W. Heine, the committee initiated a study to determine the optimum batch size for attaining maximum green sand properties in various commercial mullers.

NFA Meets in Detroit

The National Foundry Association will give honorary life memberships to four persons at its annual meeting in Detroit October 11 and 12. The Waterbury-Farrel Foundry & Machine Company will receive an award as it reaches 50 years membership in NFA.

Arthur G. Hall of Nordberg Manufacturing Company will speak on "A United Labor Front Requires a Strong United Foundry Front." Other topics will include employee communications, the steward-foreman relationship, and a panel of union and management representatives discussing "For Smoother Bargaining."

SCIENTIFICALLY DEVELOPED . . LABORATORY CONTROLLED FOUNDRY PRODUCTS

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FOR STEEL..GRAY IRON
MALLEABLE AND NON-FERROUS

DELTA
SUPERKOAT
WASH

COVERS A GREATER
SURFACE AREA..PRODUCES
SMOOTHER..CLEANER
CASTINGS...*at lower cost!*

Delta Superkoat Wash is recommended for Steel, Gray Iron, Malleable and Non-Ferrous castings. It's easy to mix and apply uniformly to green or dry sand and baked surfaces by dipping, swabbing, spraying or brushing.

NOTE THESE IMPORTANT ADVANTAGES OF DELTA SUPERKOAT WASH:

1. **NO PRECIPITATION OR SETTLING** — When thoroughly mixed, wash will stay in suspension indefinitely.
2. **EASY TO APPLY** — It can be dipped, swabbed, brushed or sprayed on green or dry sand and baked surfaces.
3. **RAPID, DEEP PENETRATION AND EXCELLENT ADHESION** Quickly anchors itself 5 to 7 grains deep in sand surfaces.
4. **NON-REACTIVE — LOW GAS** — Will not react or produce gas in contact with molten metal.
5. **REDUCED CLEANING COSTS** — Cast surfaces are smoother and castings are cleaner.
6. **WILL NOT FLAKE** — When completely dried, the wash is thoroughly bonded to the sand surfaces.
7. **HIGHLY REFRACTORY** — Has an unusually high fusion point.
8. **ELIMINATES SAND FUSION AND BURN-IN** — Flowing metal will not crack or rupture wash during pouring.
9. **ECONOMICAL TO USE** — Covers a greater surface at a lower cost per pound of wash.

Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA OIL PRODUCTS CO.
MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

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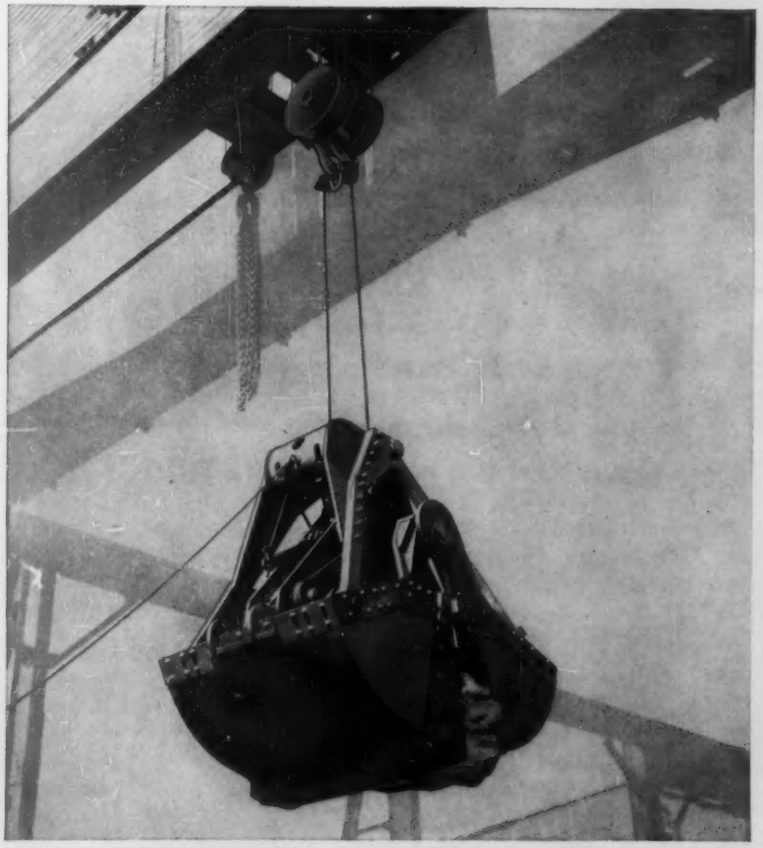
CIRCLE NO. 124, PAGE 21-22

MORE WORK . . . FASTER!
WITH ERIE STRAYER HOOK-ON CLAMSHELLS



CHECK these exclusive features:

- √ EASY HOOK-ON—no changeover problem. Versatile.
- √ COMPACT, RUGGED DESIGN—longer, tougher service.
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- √ ALWAYS UNDER PERFECT CONTROL—eliminates shock.
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THE FAMOUS **STRAYER ELECTRIC** BUCKET
ALSO AVAILABLE FOR AC OR DC OPERATION

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CIRCLE NO. 125, PAGE 21-22

products and processes

Powdered resin, Admirez CC-240, contains a cure catalyst which promotes rapid transformation from low melting point material to hard infusible solid under influence of heat. Resin applied to sand by cold coating process. *Archer-Daniels-Midland Company.*

CIRCLE NO. 1, PAGE 21-22

Ultrasonic thickness measuring instrument SO 100 Sonizon weighs 30 lbs. It has visual cathode tube presentation and operates on 115 v, 60 cycle current. Will operate on almost every sound conductive material. *Magnaflux Corp.*

CIRCLE NO. 2, PAGE 21-22

Remote electric counter works on electro-mechanic principle allows up to 200 weighings a minute and is able to tabulate and record a weighing process from any point. Device prevents double counting. It comes in models 31-41 and 31-42. *Richardson Scale Co.*

CIRCLE NO. 3, PAGE 21-22

Insulating ceramic fiber blanket, Fiberfrax, resists temperatures to 2300 F, also retains form and properties. Recommended for high pressure steam, exhausts, furnace ducts, furnace linings. *The Carborundum Co.*

CIRCLE NO. 4, PAGE 21-22

Dust collector has all welded construction with self cleaning design. Hydro-Filter has three-way particle separation system. CFM capacities run from 6,000 to 28,000. *National Dust Collector Corporation.*

CIRCLE NO. 5, PAGE 21-22

Binder for both old and new sand without the addition of core oil contains 48 to 50 per cent ash and is marketed as "Dri-Bond." It will not deteriorate on aging and has no allergic effect. *Delta Oil Products Co.*

CIRCLE NO. 6, PAGE 21-22

Shell molding machine, "Chicopee Core Chief" designed for green sand, permanent mold or shell molding operations. Will use hinged, split or solid core boxes. *Shell Process, Inc.*

CIRCLE NO. 7, PAGE 21-22

Cold repair of cracked or broken castings by Chain Lock method now comes in kit form. Process is said to bind and lock two sides of break together and then seal the crack, both water and pressure tight. *Chain-Lock Process Company.*

CIRCLE NO. 8, PAGE 21-22

Rail tractor built to pull two rail cars with gross load of five tons. Unit is self propelled and driven by storage battery. Operates on 24 in. gage track. *Easton Car & Construction Company.*

CIRCLE NO. 9, PAGE 21-22

Heating ovens featuring infrared radiation also have sheathed resistance rod-type heater panels readily assembled due to patented building block

construction principle. Known as Pan-L-Heat ovens. *Jensen Specialties, Inc.*
CIRCLE NO. 10, PAGE 21-22

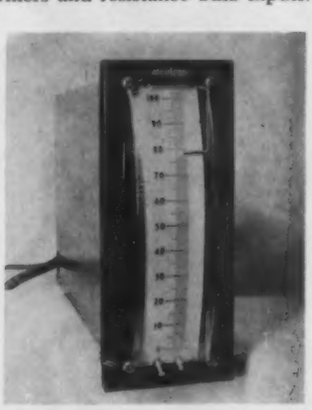
Portable Brinell hardness tester has removable test head allowing for testing of any size. It puts load of 3000 kg

on 10 mm ball. Not affected by vibration and will test in any position. *King Tester Corporation.*
CIRCLE NO. 11, PAGE 21-22

Aluminum roof coating made of aluminum flakes, bitumen and asbestos fibres. One gal. covers up to 200 sq ft. Applied by brush or spray. *Stonhard Company.*
CIRCLE NO. 12, PAGE 21-22

Temperature indication materials include Tempilstik for 525 F as well as 575 F. Others in line are pellets and a marking liquid. *Tempil Corp.*
CIRCLE NO. 13, PAGE 21-22

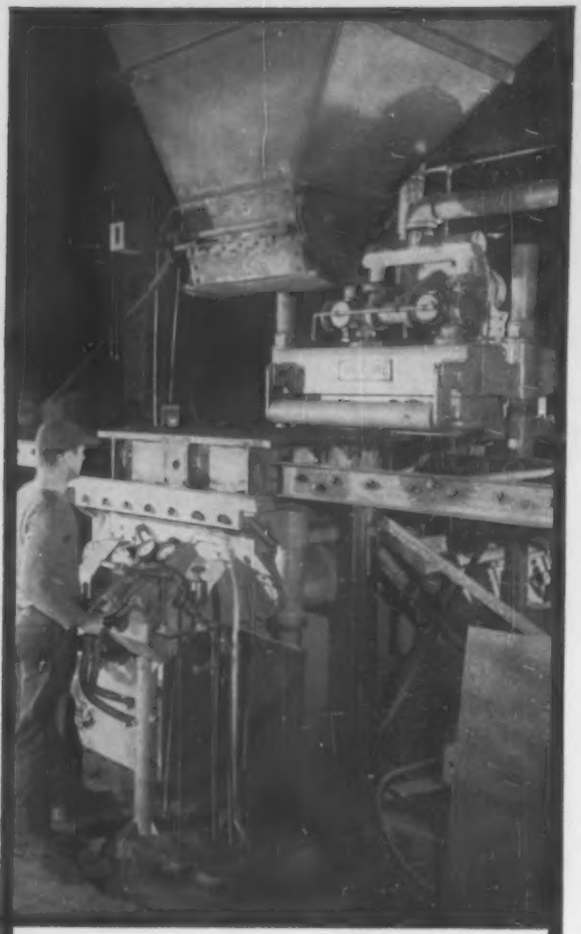
Vertical scale indicator is a semi-null balance for use with differential transformers and resistance bulb inputs. It



is servo-driven and has six in. scale with one degree graduations. *Automatic Temperature Control Co.*
CIRCLE NO. 14, PAGE 21-22

Variable remote control system allows both positioning and proportioning plus monitoring of remote equipment over one circuit. May be used with present operators or supplied with

TACCONE DIAFORM MOLDING MACHINE



NEW MODELS

FOR FLASKS RANGING FROM

12"x18" TO 48"x60"

★ **The first completely new method of green sand molding in eighty years.**

★ **Designed for all production rates from full jobbing to full automation.**

★ **Uniform mold hardness assures quality castings of all metals.**

Diaform molding with the *Taccone Machine* is the first successful use of the diaphragm method of molding in production and jobbing foundries. It provides squeeze pressure from two to ten times that used by previous molding practice and, therefore, completely eliminates the need for jolting. As a result, maintenance of equipment and patterns is drastically reduced and noise can be virtually eliminated.

The diaphragm "contours" around the pattern to eliminate the need for peen blocks, tucking or hand work. The diaphragm produces high-pressure squeeze in all directions—three times the efficiency obtainable with a flat squeeze board. Full high-pressure molding effects are available with ordinary air pressures.

High speed molding is possible with the *Taccone Molding Machine* because of the absence of moving parts such as jolt and squeeze pistons, an important factor, too, in the reduction of maintenance. Many existing units are on full automation. "Push button" molding guarantees repetitive quality with a minimum of supervision. At the same time, the versatility of the diaform principle provides quality in low production and jobbing castings.

There is no substitute for a uniform mold hardness. It is easy to prove that many of the known casting defects are related directly to lack of uniformity. In addition, mold density is a "must" for casting precision whether the problem is dimension control or simply weight control.

"Precision" green sand castings can be produced only with high-pressure squeeze.

High-pressure squeeze can be obtained most effectively with the Taccone Diaform Molding Machine.

SPEED . . . QUALITY . . . LOW MAINTENANCE . . . VERSATILITY

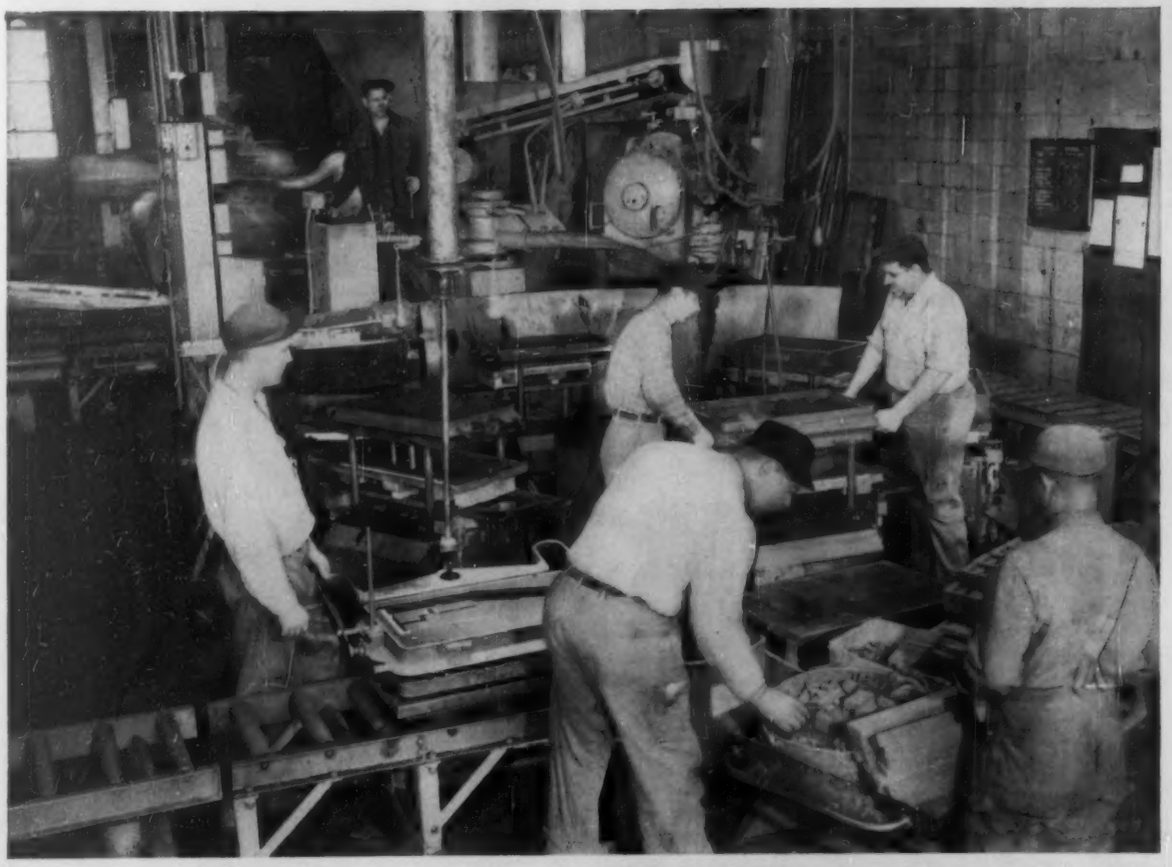
EASTERN CLAY *products dept.*

INTERNATIONAL MINERALS & CHEMICAL CORPORATION, 20 North Wacker Drive, Chicago 6

DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • PLASTI-BOND • REVIVO CORE PASTE • CUPOLINOR • CUPOLINE • TACCONE MOLDING MACHINES

CIRCLE NO. 126, PAGE 21-22

There's a slinger unit designed for every job



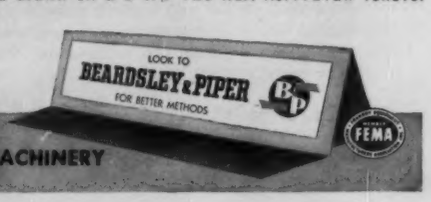
A CASE STUDY at the Detroit Stoker Company, Monroe, Michigan where this Hydra-Slinger Roto-Mold Unit handles many of the foundry's medium size production and semi-production patterns on an efficient production cycle.

Two efficient molding units—each built around a slinger — have recently been installed at the Detroit Stoker Company, Monroe, Michigan. One unit, with Hydra-Slinger, B & P Roto-Mold turntable and six B & P Speed-Draw Machines, handles the foundry's production and semi-production work. The other unit with Sandslinger and B & P Rol-A-Draw rollover draw machine handles the jobbing work.

Both units are ideally adapted to the range of work handled, and both have contributed greatly to the overall success of this foundry. This plant offers an excellent example of how slinger mechanization can meet greatly varying requirements.

There are slinger units designed for every job—from loose pattern jobbing work to highest production repetitive production work. Bulletin 320 has all of the facts . . . send for your copy today. Beardsley & Piper, 2424 N. Cicero Ave., Chicago 39, Illinois.

LARGER JOBBING WORK at Detroit Stoker is rammed by this Stationary Sandslinger served by roller conveyor. These molds are rolled over and drawn on a B & P 920 RCX Rol-A-Draw rollover draw machine.



THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

CIRCLE NO. 127, PAGE 21-22

motors and pilot operators. *Sparton Control Systems Div., Sparks-Withington Co.*

CIRCLE NO. 15, PAGE 21-22

Crawler tractor which utilizes "knock-out" feature for handling of sticky materials is one of TerraTrac line which

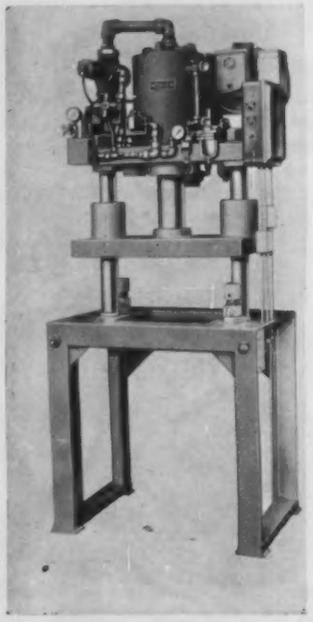
includes eight gasoline and diesel-powered models from 36.5 to 62 hp. *American Tractor Corp.*

CIRCLE NO. 16, PAGE 21-22

Metal connector, known as "Fishbone" used for joining surfaces of wood or metal. Connector fits between surfaces to be joined, splines into pre-drilled holes. *Fun-iture Co.*

CIRCLE NO. 17, PAGE 21-22

Hydraulic trim press, 20 ton, designed for high speed die cast work. Stroke adjustable from 0 to 12 in., speed to



66 inches per minute free ram travel. Mfr. claims new cylinder and ram eliminates galling and scoring. *Mohler Engineering Co.*

CIRCLE NO. 18, PAGE 21-22

Metal stabilizer, Sun Brite, is said to clean metal, degass, refine grain,

homogenize, add ductility and to be usable as a cover. *Michael Scott Co.*
CIRCLE NO. 19, PAGE 21-22

Air-supplied suit designed for work at temperatures of 175 F. Mfr. claims schedule of 105 min in and 15 min

out at this temp. Removable air manifold at back distributes air through tubes. *Union Industrial Equipment Corp.*
CIRCLE NO. 20, PAGE 21-22

Refractory brick which is 98 to 100 per cent aluminum oxide is said to virtually eliminate metals contamination in reverberatory type furnaces. *Electro Refractories & Abrasives Co.*
CIRCLE NO. 21, PAGE 21-22

Hammer with detachable metal and plastic caps is made in Holland. Heads

attachable to either side and weigh from ounces to over two lbs. *Netherlands Trade Commission.*
CIRCLE NO. 22, PAGE 21-22

Clinical two-channel audiometer, model 15-A, is said to be able to conduct nearly all types of hearing

DIET FOR A HUNGRY CUPOLA . . .
Famous CORNELL CUPOLA FLUX
USE FAMOUS CORNELL CUPOLA FLUX with each ton charge of iron. Your iron will be cleaner. Your scrap losses will be less. You'll get greater tensiles and the increased lining life both in cupola and ladles will save you money in manpower and materials. Why not call a Cornell Flux engineer today and assure yourself of cleaner iron every time.
"often imitated but never equalled"

P. S. If you melt aluminum or brass, try Famous Cornell Aluminum and Brass Flux. Write for Bulletin 46-A.

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Trade Mark Registered

CIRCLE NO. 128, PAGE 21-22

tests. Has octave frequencies from 125 to 8,000 cycles with intermediate frequencies from 750 to 6000 cycles. *Beltone Hearing Aid Company.*

CIRCLE NO. 23, PAGE 21-22

Brinell microscope has patented three-way construction which needs no eye adjustment. It is designed for inaccessible locations and has battery operated light for dark areas. *King Tester Corporation.*

CIRCLE NO. 24, PAGE 21-22

Single wall gravity ovens, known as Blue M, have automatic hydraulic thermostat, temp range 40 to 200 C with fresh air intakes. Recommended for preheating, drying or sterilizing. *Soiltest, Inc.*

CIRCLE NO. 25, PAGE 21-22

Seam detector, Magnatest FW-400, for testing discontinuities in non-magnetic tube and rod up to 3 inches dia. High speed operation, may be 100 per cent automatic. *Magnaflux Corp.*

CIRCLE NO. 26, PAGE 21-22

Industrial tractor the "Work Bull", comes in three models, 34, 42, 52 hp. Available with integrated power and equipment packages. All operated on 12 v electric system. *Massey-Harris-Ferguson, Inc.*

CIRCLE NO. 27, PAGE 21-22

High-heat resistant flooring brick is made with Cortland emery aggregate which also has thermal shock resistance. No specialized curing or scarification needed with Emeri-Brick. *Walter Maguire Co., Inc.*

CIRCLE NO. 28, PAGE 21-22

High power magnetostriction type transducer designed for large scale ultrasonic cleaning, degreasing, descaling, plating and other metalworking and finishing operations. Transducer rated as 400 watt, 25 kilocycle. *Acoustica Associates, Inc.*

CIRCLE NO. 29, PAGE 21-22

Inspection marking unit known as "Airgrit" leaves an etched impression by blowing fine abrasive grit. Designed for use on machined, glazed or polished surfaces. Both depth of marking and marking time cycle are adjustable. *Jas. H. Matthews & Co.*

CIRCLE NO. 30, PAGE 21-22

Power saw guard "Tensee" sheathes circular saw in transparent plastic shield and allows cutting of materials three-eighths in. long. Twin steel arms

CIRCLE NO. 129, PAGE 21-22

ADM presents with pride the V.I.P.* of core binders...

HOW DOES LinOSet SPEED PRODUCTION?

1. Reduces man hours by 50% or more fabricating large cores.
2. Fewer rods are needed for reinforcement because LIN-O-SET cores are stronger before and after baking.
3. Average baking time is reduced by 30%.
4. Collapsible LIN-O-SET cores shake out like sugar . . . drastically reduce cleaning time.

HOW DOES LinOSet IMPROVE CASTING QUALITY?

1. LIN-O-SET cores resist deformation during baking; maintain excellent dimensional stability; set up on contact with core box.
2. Sand systems are uncontaminated by LIN-O-SET.
3. LIN-O-SET cores improve casting finish.

ANY OTHER LinOSet ADVANTAGES?

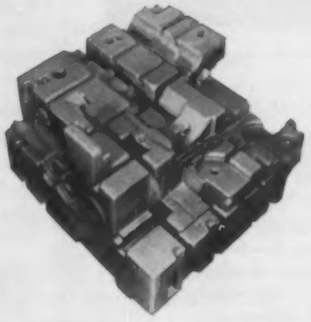
1. LIN-O-SET lets you accurately control set-up time regardless of operational or climatic conditions.
2. LIN-O-SET is immediately adaptable to practically all sand mixing procedures. No special measuring or mixing equipment needed.
3. LIN-O-SET cores do not produce toxic fumes or objectionable odors.
4. Normal wash procedures may be employed without damage to cores.
5. LIN-O-SET and LIN-O-SET bonded cores offer indefinite storage life.

Lin-O-Set

✱ V.I.P. means very important product—very important to foundrymen looking for ways to cut costs. More than just another binder, LIN-O-SET is a *New Method* of core making designed especially for medium-to-heavy work and especially suited to jobbing foundries. A specialized quick curing core binder that "sets up" at room temperature, the purpose of LIN-O-SET is to speed production and improve casting quality.

SOME FOUNDRIES SAY: "It's expensive *Not* to use new LIN-O-SET." For instance, these examples of heavy, intricate cores are produced in a comparatively short time and with no complications . . .

AT ST. MARYS FOUNDRY CO., *St. Marys, Ohio:*



Intricate St. Marys core made with LIN-O-SET was used to produce a horizontal boring mill head weighing 2946 lbs. and measuring 31½" x 36" x 44". Ramming and finishing this core was regularly a 5¾ hour job. With LIN-O-SET it now takes only 1¼ hours . . . over 3 times as fast.

AT STATE FOUNDRY CO., *Akron, Ohio:*

New LIN-O-SET core mix enabled State Foundry to fabricate this 1740 lb. core in 1¾ hours, a job which previously took 8 hours using conventional binder. This core, measuring 31" x 39" x 27", is used in producing a 62" vertical boring mill base.

Archer · Daniels · Midland company

FOUNDRY PRODUCTS DIVISION • 2191 WEST 110th ST., CLEVELAND 2, OHIO

LINOIL | INDUCTOL | LIN-O-CEL | FRE-FLO | ADMIREZ | Lin-O-Set

suspend shield above saw in fixed position. *Brett-Guard Co., div. Glenwood Industries, Inc.*

CIRCLE NO. 31, PAGE 21-22

Hydraulic testing machine, AP-350, has capacity to 30,000 lb. Accurate to within one per cent of indicated load, meets A.S.T.M. specifications. Cross head speeds adjustable up to six in. per minute. *Soiltest Incorporated.*

CIRCLE NO. 32, PAGE 21-22

Overhead clothing baskets, called Lockerbaskets, claimed to give increased sanitation at lower cost. Unit is suspended near roof to take advantage of air and light. *The Moore Company.*

CIRCLE NO. 33, PAGE 21-22

Pallet boxes, standardized and wirebound are easily assembled and knocked down. Will handle loads up to 3,000 lb. Also available are one-time shippers handling up to 1,500 lbs. *General Box Co.*

CIRCLE NO. 34, PAGE 21-22

Glasses feature temple hooks which rotate through 360 deg with telescoping action. Retrax Temple has plastic construction with flexible hinges. *Watchemoket Optical Co., Inc.*

CIRCLE NO. 35, PAGE 21-22

Contour scraper consists of 26 permanent, flexible prongs which allow use on flat or irregular surfaces. Blades of 0.075 in. spring steel are set into wood handle with epoxy resin. *Rerecich Co.*

CIRCLE NO. 36, PAGE 21-22

Chain block, air powered weighs 55 lb can lift to 900 lb at 36 fpm. It operates from a half-inch air line at 85 psi. Air-Motor Hoist MT-504 designed for machine shops and contractors' use. *Atlas Copco Eastern, Inc.*

CIRCLE NO. 37, PAGE 21-22

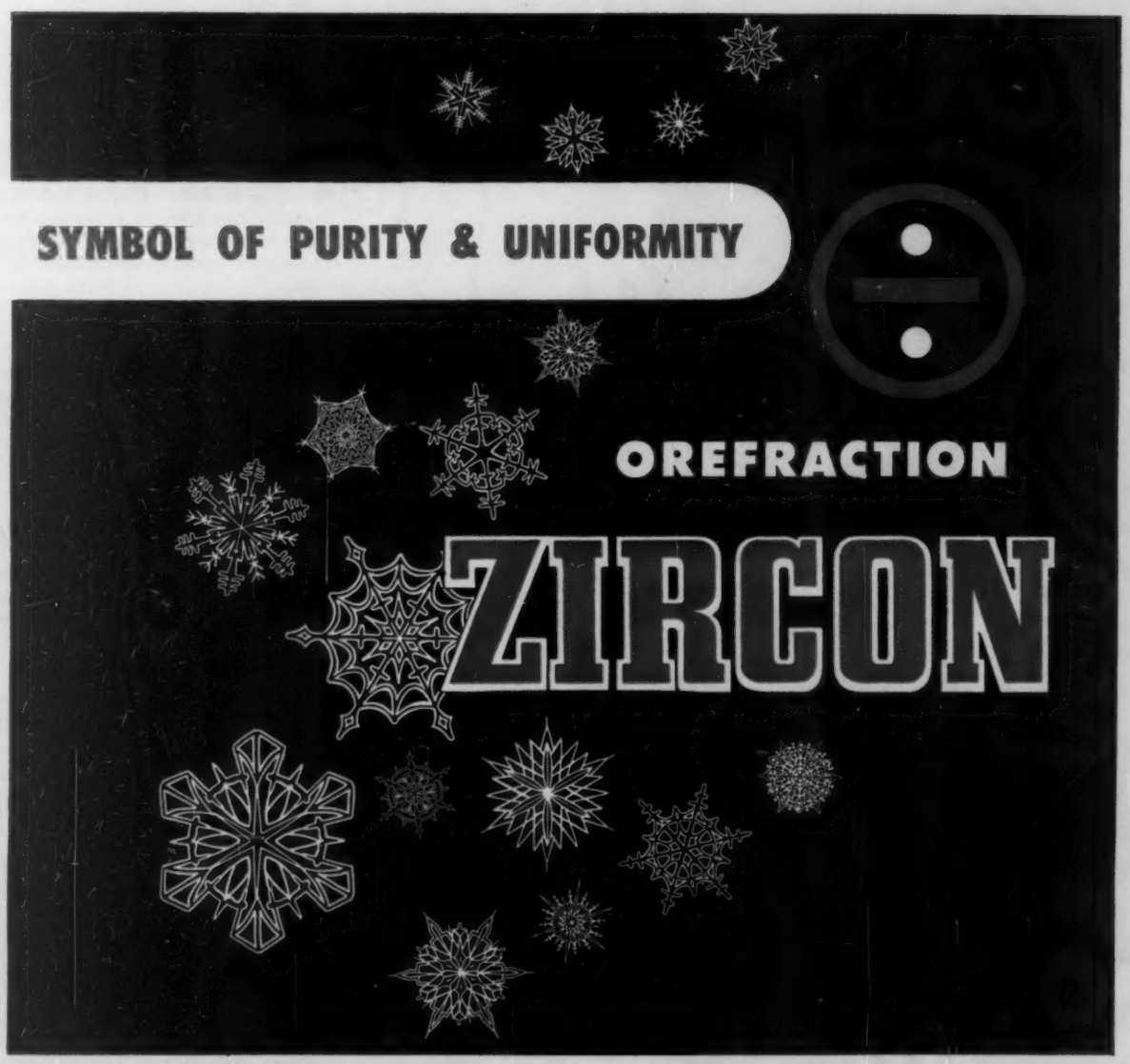
Portable compressor "Gyro-Flo 85" is rated at 85 cfm and weighs 1840 lb fully equipped. It is driven by four-cylinder, four-cycle gasoline engine and operates on six-volt battery system. *Ingersoll-Rand.*

CIRCLE NO. 38, PAGE 21-22

Dust collector operates on centrifugal collection principle for cleaning gas, is known as Cyclo-Trell. It has multiple tubes and high velocity inlet vanes and pressure recovery vanes in outlet tubes. *Research-Cottrell, Inc.*

CIRCLE NO. 39, PAGE 21-22

CIRCLE NO. 129, PAGE 21-22



SAND AND FLOUR

- Domestic and Australian zircon foundry sands
- Zircon foundry flours in 200 and 400 mesh particle sizes

Orefraction Inc.

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CIRCLE NO. 130, PAGE 21-22

1957 AFS Apprentice Contest Opens Oct. 1

The 1957 Robert E. Kennedy Memorial Apprentice Contest of the American Foundrymen's Society opens October 1, 1956, with provisions for entry of beginners as well as bona fide apprentices.

Competition is open in five divisions; wood patternmaking, metal patternmaking, iron casting (all ferrous casting other than steel), steel molding and non-ferrous molding.

Prizes of $100, $50 and $25 will be awarded to first, second and third place winners in each of the five divisions. In addition, first place division winners will have their round trip rail and pullman transportation paid between home and the convention city. All other costs will be paid by the winner, his company or the chapter.

In 1956 the First Engineered Castings Show will be held May 6-10 in Cincinnati.

Last year there were 431 apprentice entries representing 153 companies and 15 AFS chapters in the United States and Canada.

Under eligibility rules the term "apprentice" is understood to mean a learner or trainee in the all-around practices of the trade who has not had over five years experience in the pattern trade nor more than four years in the foundry trade.

Students of trade, vocational or high schools are eligible to enter the individual chapter contests at the discretion of the chapter involved. Such entries, if successful in chapter competition, are considered on an equal basis with regularly enrolled apprentice entries.

The amount of apprentice training completed has no bearing on eligibility for this contest and is not considered in the judging.

Neither the apprentice nor the companies by which they are employed are required to be members of AFS.

Answer questions by sending for data describing the newest products and processes. Order now by using the cards on **page 21-22.**

CIRCLE NO. 131, PAGE 21-22

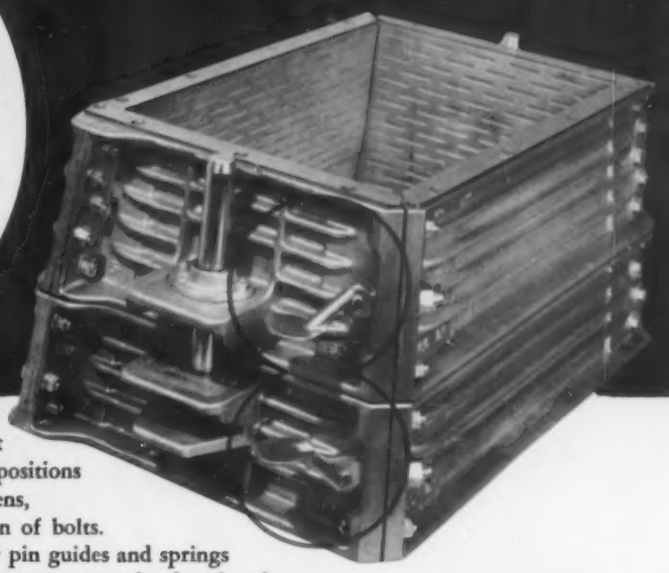
for MORE and BETTER MOLDS...

you can't beat the

MONARCH

KWIK-STRIP

MECHANICAL CORNER FLASK



Locking handle bolts work directly in a straight line. Handles can be placed in any one of four positions (up and down position shown above). Flask opens, closes and locks with positive straight line action of bolts. Binding on working corner is eliminated. Corner pin guides and springs are completely sealed against sand. All working parts are case hardened and cadmium plated. Draw pins are hard chrome plated, centerless ground and polished for true diameter. Forged and plated guide bushings. Cold Rolled wear strips are standard on top of cope and bottom of drag. Wear strips on parting flanges optional. Sides are flat so flask can be set on edge without danger of tipping.

CONSTRUCTION Precision built from cast aluminum or magnesium. Made with the most modern jigs and fixtures and machine tools to insure accuracy.

STANDARD SIZES 12″ width x 4″ depth to 30″ width x 7″ depth; 12″ long x 4″ depth to 30″ long x 7″ depth, in increments of one inch. Upsets available in 1″ x 2″ depths 4° and 5° tapers available.

Cast aluminum or iron jackets available to fit all flask sizes listed above.

"Another Foundry product by"... **NEWAYGO** engineering company newaygo, michigan

FROM INDIVIDUAL UNITS TO COMPLETE SYSTEMS

our job is serving your sand handling needs better

COMPLETE SANDHANDLING SYSTEMS

CAR CONVEYORS

PALLET TYPE CONVEYORS

REDDY SANDY

SUPER HANDY SANDY

HANDY SANDY

"Foundry Business is **BIG** *Business"*

NEWAYGO engineering company

NEWAYGO, MICHIGAN

. . . and profitable too, with **NEWAY® MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT**

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THE FOUNDRY SUPPLY CO., INC. 7600 Highway 7 Minneapolis 16, Minnesota Telephone: West 8-2765	Iowa (except Davenport area) Minnesota, Nebraska		**MR. L. C. (Carl) BEERS** 19021 Hillcrest Blvd. Birmingham, Michigan Telephone: Midwest 4-7798	Special representative in the Detroit Area
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MR. R. W. FERGUSON Newaygo Engineering Co. Newaygo, Michigan Telephone: 3821	Michigan (northern half) Michigan (Upper Peninsula)			

LITHO IN U.S.A.

Canadian Conference Set for November

Two technical sessions will highlight the American Foundrymen's Society's 6th All Canadian Conference November 8 and 9 at the Mount Royal Sheraton Hotel, Montreal.

Morning activities the first day will consist of registration at 8 am and plant visits in the morning fol-

W. T. Shute

lowed by a welcoming luncheon. In the afternoon the technical sessions will be held. "*Plastics for the Foundry*" will be presented by Walter E. Wenninga, president of Waldor Enterprises Ltd., Montreal, and "*Shrinkage Effects and Control in Cast Iron*" will be described by John Allan, St. Catherines Brass Works, St. Catherines, Ontario.

In the evening, I. H. Dennen, editor of *Better Methods*, will present "*Mechanization in Small Foundries*," a film by Beardsley & Piper.

On the second day plant visits will start at 9 am and in the afternoon Everett Chapman, consulting engineer of West Chester, Pa. will present "*Nitches & Notches*", a discussion of effects of design and workmanship on stress distribution and endurance of metal structures. The conference will be concluded with a social hour and banquet.

Heading the members of the organizing committees are W. T. Shute, Canadian Car & Foundry Co., Ltd., conference chairman in charge of technical program and A. J. Moore, Canadian Bronze Co., Ltd., conference vice-chairman, publicity and arrangements committee.

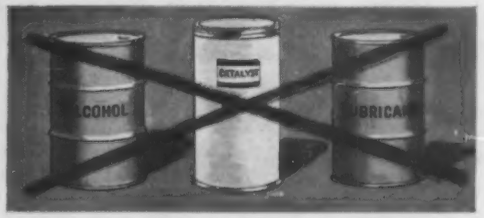
CIRCLE NO. 131, PAGE 21-22

NEWS FOR SHELL MOLDERS FROM RCI

New RCI system simplifies cold coating of sand

May be used for producing shell molds or shell cores by dump box or blowing methods

Now, with the new RCI system, *all you need is two materials* for cold coating sand (besides the sand). One is a powdered phenolic resin, RCI FOUNDREZ 7555. The other is an alcohol solution of a phenolic resin, RCI FOUNDREZ 7150.



No longer do you need to purchase and handle alcohol, catalysts, lubricants and so forth.

Amount of resin needed: The amount of resin required for a given mix will, of course, depend on whether you are coating sand for dump-box operation or for blowing shells and cores (and will vary considerably with the type of sand used). But the experience of RCI Technical Service men in the field indicates that for shell cores about 2-4% resin will be satisfactory. For dump-box operations or blown shells a range of 3-5% will generally be enough.

Other Advantages of RCI coating system

1. **Speed of coating**—release of alcohol from the resin itself accelerates actual coating of the sand. You cut mulling time about 35 to 45% . . . **reduce resin dust, too.**
2. **Strength of bond**—because the RCI system coats more efficiently than the powder and alcohol method, you get greater dry tensile strength (on an equal solids basis). You also get better economy and reduced gas content.
3. **Rate of production**—lowered investment time as well as cure time with this system gives you a higher rate of production for both cores and molds.
4. **Release characteristics**—you will find a marked improvement in the ease with which cores and molds are released from the boxes and patterns.
5. **Resin stability**—both the powdered resin, FOUNDREZ 7555, and the liquid resin, FOUNDREZ 7150 are very stable. You can store them for long periods of time (the powdered resin kept cool and dry to prevent lumping).

Write for full information. If you would like to know the procedure and typical formulations for simplified cold coating with the new RCI system, write today for *Technical Bulletin F-10.*

Creative Chemistry . . .
Your Partner in Progress

RCI

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Synthetic Resins • Chemical Colors • Industrial Adhesives • Plasticizers
Phenol • Formaldehyde • Glycerine • Phthalic Anhydride • Maleic Anhydride
Sodium Sulfite • Pentaerythritol • Pentachlorophenol • Sulfuric Acid

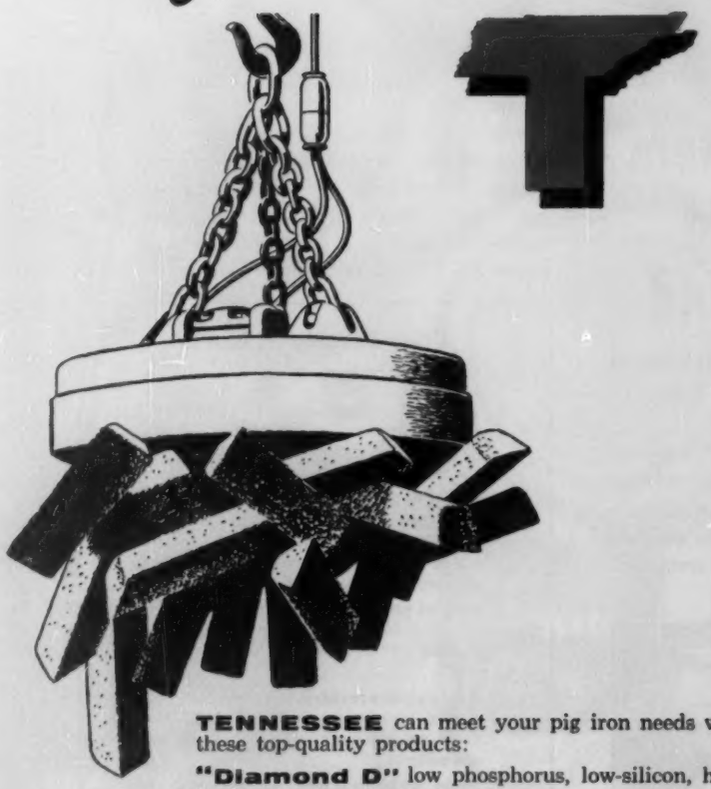
REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.

CIRCLE NO. 132, PAGE 21-22

There's

TENNESSEE PIG IRON

to suit your needs to a



TENNESSEE can meet your pig iron needs with these top-quality products:

"Diamond D" low phosphorus, low-silicon, high carbon, for high-strength castings.

"Peerless" foundry grade for soil pipe, stoves and low-strength castings.

"Rockwood" malleable for machinery and automotive parts.

Also available: Rockwood basic, Roane intermediate phosphorus.

Other **TENNESSEE** metallurgical products: Ferro alloys and foundry coke.

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PRODUCTS & CHEMICAL
Corporation
NASHVILLE, TENNESSEE.

CHEMICAL, PAINT AND METALLURGICAL DEPARTMENT OF MERRITT-CHAPMAN & SCOTT CORPORATION
CIRCLE NO. 133, PAGE 21-22

let's get personal

Harold F. Bishop . . has left the Naval Research Laboratory to join Exomet, Inc., Conneaut, Ohio, as technical director. Bishop, recent winner of the Joseph S. Seaman Gold Medal of AFS, will be in charge of research and development, and quality and process control.

Columbian Bronze Corp., Freeport, L.I., manufacturer of propellers and marine accessories, has been acquired by **Alexander B. Paulsen,** Long Island builder, and **Bernard N. Ames,** a vice-president of the firm. Paulsen is now chairman of the company and Ames president.

Two metallurgists have been promoted at New York University. **Dr. Harold K. Work,** director of the research division of the College of Engineering, has been named also professor of research management. **Dr. Harold Margolin,** engineering scientist, has been named also associate professor of metallurgical engineering.

Walter S. Giele . . Lebanon, Pa. consulting foundry engineer celebrates his 40th year in the castings industry with his election as chairman of the AFS Philadelphia chapter and as general chairman of the 1957 East Coast Regional Foundry Conference.

Syntron Co. personnel changes include addition of **R. J. Walker** to Syntron Central Pennsylvania Sales Co. office and addition of **H. J. Bertolet** to staff of Syntron Reading Sales Co.

J. Donald Judge . . has been named director of research and engineering of Hamilton Foundry & Machine Co., Hamilton, Ohio. Active in AFS, ASM, and FEF activities, Judge joined the Hamilton company as an engineer in 1924.

Harold L. Gebike . . secretary-treasurer of Electro Refractories & Abrasives Corp., has been named chairman of the national committee on ethics and eligibility standards of the Controllers Institute of America.

John Wallerius . . has moved from post as president of Sigma Metallurgical Co. to position as chief engineer of Lindberg Industrial Corp.

Stephen Blackford . . has retired as superintendent of the iron foundry at Crouse-Hinds Co., Syracuse, N. Y. Blackford moved from E. C. Stearns & Co. in 1917 to supervise the first foundry at Crouse-Hinds.

Walter Proemba . . has been named assistant sales manager of Alloy Precision Castings Co., Cleveland.

Whiting Corp. has named the following new officers: **W. Hebble,** vice-president in charge of operations; W.

W. S. Giele

J. D. Judge

H. F. Bishop

A. Morey, vice-president in charge of research; and **N. C. Swigart**, vice-president in charge of purchasing.

Herbert P. Strack, Jr. . . . is the new east coast regional manager for Coles Cranes, Inc., Joliet, Ill.

W. A. Kellogg

Wier A. Kellogg . . former eastern district manager of National Engineering Co. has been elected a vice president of the firm.

John W. Mason . . senior advertising specialist for General Electric's Metallurgical Products Dept. has been appointed manager of advertising and sales promotion.

American Society for Metals has announced candidates for 1956-1957 terms in the society's two top offices. **Dr. Donald S. Clark**, California Institute of Technology, has been nominated for president, and **George M. Young**, technical director of the Aluminum Co. of Canada, has been nominated for vice president.

Art Zrimsek . . has been named research foundry engineer for Magnet

A. Zrimsek

Cove Barium Corp. and will direct operations at the firm's newly formed foundry laboratory in Des Plaines, Ill.

Walker G. Dollmeyer . . has been named to the newly created post of

find out how you can bake your cores better, faster more economically ELECTRONICALLY! in

This Coleman CD-150 Dielectric Core Oven bakes over 8,000 pounds of urea-bonded pipe fittings cores per hour at Alabama Pipe Company, Anniston, Ala. Total time on conveyor is 11 minutes!

COLEMAN Dielectric OVENS

Which is better for you . . . dielectric or recirculating air core ovens?

As builders of the world's only complete line of foundry ovens, only Coleman Oven Engineers can give you practical, unbiased recommendations for your particular application.

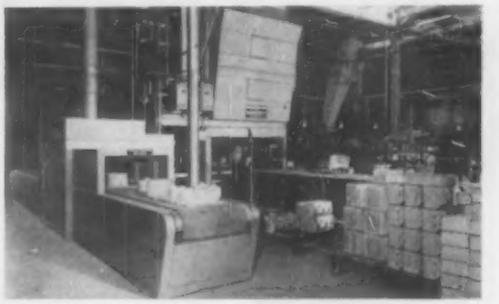
The foundries pictured are typical users of Coleman Dielectric Core Ovens. These ovens were installed after a thorough study by Coleman Oven Engineers indicated that dielectric core baking would be the most economical method in each case.

Because of this approach, based on over half a century of foundry "know how" combined with the latest electronic technology, every Coleman Dielectric Core Oven installation has been extremely profitable. Important savings have been made in time . . . in manpower . . . and through increased production.

Consult a Coleman Oven Engineer. There is no obligation. As builders of the world's only complete line of foundry ovens we have no reason to recommend anything but the best oven for your needs . . . We build them all.

WRITE FOR BULLETIN 54.

The Deming Co., Salem, Ohio, uses their Coleman CD-25 Dielectric Core Oven to bake a wide variety of phenol-bonded cores for cast iron and brass pump castings.



Hills-McCanna Company, Chicago, Ill. bakes 1500-1700 pounds of cores per hour for magnesium aircraft engine castings in their Coleman CD-25 Dielectric Core Oven.

THE FOUNDRY EQUIPMENT COMPANY
1825 COLUMBUS ROAD **CLEVELAND 13, OHIO**
WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

A COMPLETE RANGE OF TYPES AND SIZES . . .
for every core baking and mold drying requirement:
Tower Ovens • Horizontal Conveyor Ovens
Car-Type Core Ovens • Car-Type Mold Ovens
Transrack Ovens • Rolling Drawer Ovens
Portable Core Ovens • Portable Mold Dryers
Dielectric Core Ovens

CIRCLE NO. 134, PAGE 21-22

vice-president, operations, for Solar Aircraft Co. He has been vice-president in charge of manufacturing of the Toledo Scale Co.

Charles B. Martin . . has been named to serve as abrasive engineer in the West Virginia area for Norton Co.

W. R. Kanda

W. R. Kanda . . has left Cleveland Electric Illuminating Co. to join Petzinger Engineering Co., Cleveland manufacturer's representatives serving the castings industry.

David Matter . . has been appointed manager of iron foundry service for Ohio Ferro-Alloys Corp., Canton, Ohio. He was foundry research metallurgist for International Harvester.

Burton R. Buck . . has been appointed a vice-president of Electro Metallurgical Co., a division of Union Carbide and Carbon Corp.

Karl T. Rinderle . . is now a field engineer for Westover Corp., Milwaukee,

K. T. Rinderle

after serving as vice-president of operations for Brown Industries Inc. for the past 12 years.

Stevens Institute of Technology, Hoboken, N. J., has announced two faculty appointments in the metallurgy department. **Dr. Rolf Weil**, for-

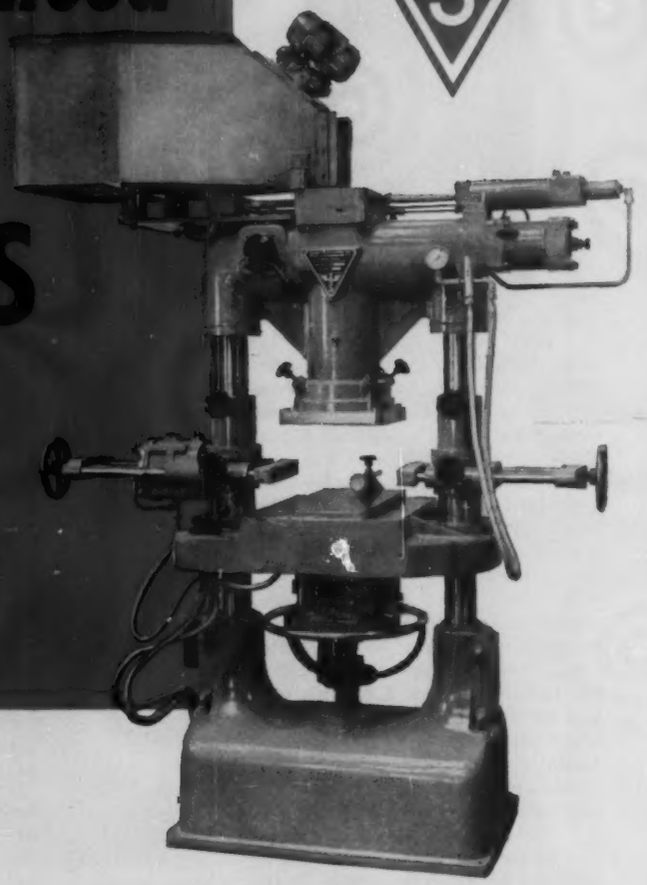
CIRCLE NO. 135, PAGE 21-22

Team-Mates . . .

Everything you need for the CO_2 PROCESS

CARVER

FOUNDRY PRODUCTS CO.



Carver Foundry Products is the most experienced organization in the U.S.A. on the CO_2 Process. Carver engineers are available to help you in all phases of this fabulous process for hardening cores and molds in a matter of seconds.

If you are now using this process, or plan to use it, let us serve you on all your requirements. If you do not use it let us tell you about its many important advantages.

KRAUSS *Self-Cleaning, Taper-Slot* CORE VENTS

The slots diverge toward the underface, preventing fine particles of sand from clogging slots, eliminating the necessity for frequent cleaning. Continuous producton assured. Krauss Core Vents are widely used for the CO_2 Process.

FORMLAC CORE and MOLD WASH
puts a hard coat on CO_2 cores that makes core handling safe. High refractory properties assure against burning in *any size casting*. Wonderful to stiffen up long delicate and thin cores. FORMLAC is excellent also for green sand molds and cores.

CARVER FOUNDRY PRODUCTS CO.
1054 Hershey Ave., Muscatine, Iowa

☐ Send a copy of Handbook on the CO_2 Process.
☐ Have a CO_2 Process Engineer call.
☐ I am interested in literature on _____

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____

CARVER . . .

. . . For Lightning Fast Production

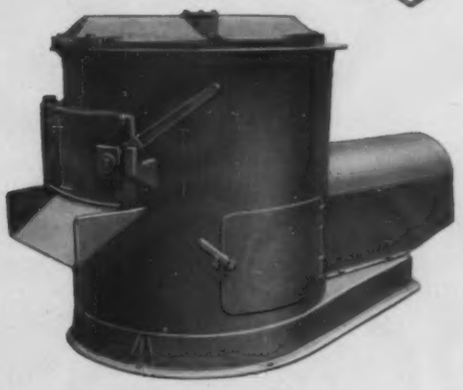
V + S Core Shooters

. . . *world's fastest core making machine!* Revolutionary new technique. • Extremely high green strength "stand up" cores can be made with any binder. • Negligible wear on wood boxes. • Very little air is used. • Economical for large or short runs. • Core boxes can be changed in one minute. • V + S Core Shooters available in 4 sizes of varying capacities.

Automatic Gassing Apparatus

Ideal team-mate for the V + S Core Shooter. Insures amazing speed in core hardening. *CORES MAY BE HARDENED THROUGH AND THROUGH IN 3 SECONDS.* Savings in CO_2 gas and labor pay for machine in a matter of weeks. Machine is 100% automatic.

V + S Rapid Sand Mixer



MOST POPULAR AND EFFICIENT MIXER IN THE WORLD — OVER 3000 IN OPERATION. Simple in design and operation — virtually maintenance free. Easy to clean. Less binder used because of higher mixing efficiently. Easier and faster to load and unload.

STEINEX

STEINEX . . .

the original CO_2 sand binder, is the standard of Quality *and comparison* throughout the world. Hardens fast, produces harder cores, less gas evolution and shakes out better. No other binder can compare with it in quality. *Made in several special grades to save our customers money and improve quality!*

Complete Suppliers for the CO_2 Process

. . . **FOUNDRY PRODUCTS CO.,** Muscatine, Iowa

merly an associate metallurgist at Argonne National Laboratory, has been named assistant professor. **Santiago Fernandez** has been named an instructor in the department.

Leonard Romano . . has been assigned to handle sales and service of Archer-Daniels-Midland Co., Foundry Prod-

L. Romano

ucts Div., products in the Buffalo area. He replaces Anton Dorfmueller who has been transferred to Cleveland.

Acheson Colloids Co., Port Huron, Mich., has announced the appointments of **E. Ralph Egloff** and **Frank H. Mrozek** as service engineers. Egloff has been assigned to the firm's Chicago office and Mrozek to the New York office.

Edward A. Kotnik . . has left General Motors Institute to join General Electric's Metallurgical Products Dept., Detroit, as training specialist.

G. H. Shackelford

Gale H. Shackelford . . has been promoted to sales manager of Canton Chaplet and Chill division of W. L. Jenkins Co., Canton, Ohio.

The Wheland Co., Chattanooga, Tenn., has promoted **Karl L. Landgrebe, Jr.,** to vice-president in

CIRCLE NO. 135, PAGE 21-22

STRESSCOAT IMPROVES CASTING DESIGN—This Magnaflux developed brittle lacquer coating is used for testing and measuring stress in working parts or designs. Stress analysis is providing new ways to reduce cost and weight of products to make them lighter, stronger and cheaper.

Case Studies:
NONDESTRUCTIVE TESTING SYSTEMS

Custom testing installation for malleable castings.

New Methods Increase Profits and Expand the Market for Castings—Help Improve Foundry Practices

MAGNATEST SORTS CONTAMINATED CASTINGS by using their conductivity to measure purity. A small hand held coil induces eddy currents in parts which in turn registers on the dial. By observing changes in this current you can determine the degree of contamination. 10,000 red brass castings were recently sorted by this means at a rate of 500 per hour.

In today's economy, the profit-minded foundryman strives for consistent quality rather than perfection. This consistency pays off for both the foundryman and user.

Magnaflux offers a variety of nondestructive testing methods to aid you in achieving consistent quality in day-to-day foundry production. For instance, consistent quality starts with good casting design. M Stresscoat is invaluable for measuring stress and load concentrations, to develop designs for light, stronger and cheaper cast parts.

Magnaglo tests on pilot runs can indicate troublesome pouring or handling practices which may contribute to cracks and other defects in finished parts. With Magnaflux, Magnaglo or Zyglo methods all severe cracks in any metal can be found and evaluated. Thus, you eliminate scrapping of good castings for seemingly visible defects that have no bearing upon the true strength or service life of the casting. If serious defects do exist, proper corrective action can be taken before further costly processing. For any selected service level, M test systems permit you to set the standards and hold to them. After correct procedures have once been established, only a sampling "finger-on-the-pulse" inspection is required to insure consistent, reliable casting production. These are profitable steps to building acceptance and expanding marketing opportunities for cast parts.

For detailed information on M applications for your specific operation, call in one of our experienced Magnaflux engineers, or write today.

FOOLPROOF METHODS FOR LARGE OR SMALL CASTINGS

M offers a variety of fast, low cost, nondestructive methods for testing ferrous and non-ferrous castings of every size and shape from watch cases to valves or side frames. Whether you require a custom installation for steady production-line operation, or a portable unit for sampling tests in your production process, we can supply systems to meet your exact needs.

HALLMARK OF QUALITY IN NONDESTRUCTIVE TEST SYSTEMS

Write for complete details concerning any of the above case studies, (excerpts from MAGNAFACTS), or ask for our new booklet on Lower Manufacturing Costs.

Take Your Inspection Problems to the House of Answers . . .

MAGNAFLUX CORPORATION

7352 W. Lawrence Avenue • Chicago 31, Illinois

New York 36 • Pittsburgh 36 • Cleveland 15 • Detroit 11 • Dallas 19 • Los Angeles 58

CIRCLE NO. 155, PAGE 21-22

charge of foundry operations and has elevated **H. F. Griscom** to the board of directors.

Frank W. Glaser . . executive vice-president and general manager of Alloy Precision Castings Co., Cleveland, has been elected a director of Mercast Ltd., London.

A. G. E. Robiette . . has been awarded the degree of Doctor of Science of the University of Wales, according to his firm, John Miles & Partners (London) Ltd.

Emanuel Singer . . representative of H. Kramer & Co., Chicago, has been named chairman of the 44th annual convention of the National Association of Waste Material Dealers, Inc.

Forest G. Boucher . . is operations manager of Shallway Corp., Connellsville, Pa. He replaces W. J. White who is now eastern district sales manager of Shalco Eng. Corp.

Joe White . . has been named Chicago district sales manager for Conco Engineering Works, Mendota, Ill., materials handling equipment manufacturer.

H. H. Kieckhefer . . has been promoted to sales manager of the Wheelco Instruments Div. of Barber-Colman Co., Rockford, Ill.

Robert W. Spacek . . has been appointed superintendent of the Peerless plant of the Wellman Bronze and Aluminum Co., Cleveland.

A. V. Lorch . . has been named pig and ingot product manager of Kaiser Aluminum & Chemical Sales, Inc.

Foster H. Pettay . . has been elected president of the Ohio Crankshaft Co.

Arwood Precision Casting Corp. has named two new directors: **William O. Sweeny**, Chappaqua, N. Y. and **Walter P. Jacob**, Waterbury, Conn.

Allen J. Filipic . . is now a sales engineer for Osborn Mfg. Co.

F. H. Mueller . . is on leave from Mueller Brass Co. to serve as assistant Secretary of Commerce for Domestic Affairs.

Marlin R. Hemphill . . is now general manager of the forging and casting manager of Allegheny Ludlum Steel Corp., Ferndale, Mich.

Expansion for Gilsonite

"Gilsonite," a high purity electrolytic coke used extensively in the aluminum industry, is going to get a big boost with completion next year of a new $16 million project to exploit large deposits in Colorado and Utah.

The project involves completion of a new processing plant, construction of one of the world's largest pipelines for transporting solid material and an expansion of Gilsonite mines.

Gilsonite is a black solid hydrocarbon with a high resin content. It has been used largely in making asphalt floor tile, storage battery boxes, inks, paints, varnishes and as insulation for hot underground pipes.

At the new plant it will be converted into electrolytic coke and high octane gasoline.

New Paint Contains Frits

Ceramic frits, pigments and refractories have been combined in a heat-resistant paint capable of withstanding temperatures up to 1400 F, it has been announced by the Army Corps of Engineers. This 153-page report, PB111957, *Development of Heat-Resistant Paints*, M. Kornbluth, may be ordered from OTS, U. S. Department of Commerce, Washington 25 for $4.

The paint was developed to reduce accelerated oxidation and rapid destruction of steel components such as muffiers and manifolds on automobiles where there are high temperatures and an oxidizing atmosphere.

Copper Consumption Rises

During the first quarter of 1956, the consumption of copper by brass and bronze foundries was the heaviest since 1951. A total of 242,237,000 pounds was used compared to 216,431,000 for the same period in 1955. The increase in total consumption by the foundries over the previous quarter was entirely reflected by a stepped up usage of copper-base alloy ingot, so shows the U. S. Department of Commerce Copper Industry Report. Consumption of ingot also reached a new high for the past four years.

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Please use card before April 1, 1957

Panel Seeks Greater Role Of Castings in Airplanes

An increased role for high-strength precision steel castings in aircraft fabrication has been recommended by a panel of representatives of airframe, steel and research industries. The group met under sponsorship of the Materials Advisory Board of the National Academy of Sciences at the request of the Department of Defense.

With the development of steel castings having an ultimate strength range of 180,000 to 200,000 psi at normal temperatures, aircraft manufacturers anticipate a considerable saving of time and manpower by their use. They would also relieve a bottleneck in industrial forging and machining capacities.

Government expenditures up to $1,250,000 annually for "several years" are recommended for establishing a program to develop acceptability and manufacturing techniques for use of castings in airframes and engines.

This 67-page report may be obtained for $1.75 by ordering PB 121148 Precision Steel Castings for Aircraft Use, OTS, U. S. Department of Commerce, Washington 25.

Steel Penetration in Sand

Laboratory conditions indicate that penetrating pressure of steel into a sand mold is proportional to the mean grain size for coarser sands, but not for fine sands, according to the British Steel Casting Research Association. Sintering, giving enlarged pores, becomes more important as the grain size is reduced.

Low binder contents, resulting in relatively poor bonding of the sand grains, allow for grain movements in compacted sand mixes and so lower the metal penetrating pressure (the pressure necessary to force molten metal into a sand compaction under standard conditions).

Metal penetration is best prevented by washes which sinter at temperatures just below that of molten steel. The viscous liquid formed completely seals the pores and covers the sand grains of the mold surface. Washes of the high silica, low alumnina type prevent metal penetration.

Name National AFS Nominating Committee

■ Nominating committee to select officers and directors for elections at the 1957 Annual Business Meeting of American Foundrymen's Society was named August 1 at a meeting of the society's board of directors.

Five committee members were named from lists submitted by chapters eligible this year to suggest members. These five, together with the two immediate past presidents, form the nominating committee which will meet December 10 in Chicago to nominate a president, vice-president, and six directors, endeavoring, as prescribed by the AFS by-laws, "to provide equitable and constant regional representation, and . . . representation for the several branches of the castings industry."

Members of the nominating committee are:

Past President Bruce L. Simpson, National Engineering Co., Chicago, *chairman*.

Past President Frank J. Dost, Sterling Foundry Co., Wellington, Ohio.

W. H. Baer, Bureau of Ships, Navy Department, Washington, D.C., representing Region 1, Chapter Group B—Chesapeake Chapter and Gray Iron, Malleable, Non-Ferrous and Steel.

Lewis T. Crosby, Sterling Wheelbarrow Co., Rocky River, Ohio. Representing Region 2, Chapter Group F—Northeastern Ohio Chapter and Supplies.

Eric Welander, John Deere Malleable Works, Deere & Co., Moline, Ill. Representing Region 3, Chapter Group M—Quad City Chapter and Malleable.

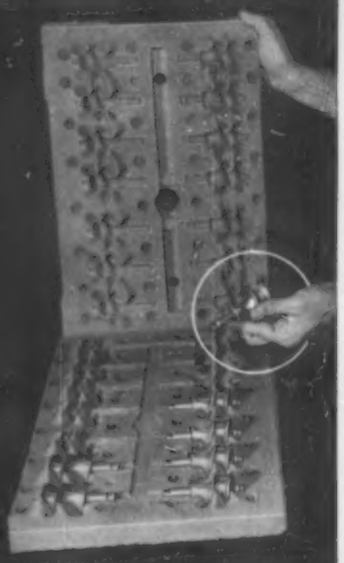
L. N. Shannon, Stockham Valves & Fittings, Inc., Birmingham, Ala. Representing Region 4, Chapter Group O—Birmingham District Chapter and Malleable, Gray Iron and Non-Ferrous.

Hubert Chappie, National Supply Co., Torrence, Calif. Representing Region 5, Chapter Group Q—Southern California Chapter and Steel and Gray Iron.

FOR FASTER CURES . . . SMOOTHER SURFACES . . . BETTER CASTINGS

CATALIN SHELL MOLDING RESIN 9616

View of automatic shell mold machine, indicating shell ejection operation, shown to left . . . And a typical shell mold specimen, shown below . . . were photographed at the foundry of C. A. Goldsmith Company, Newark, N. J.



Higher production rates, new advanced techniques and automatic equipment, smoother and more accurate castings are the direct industrial contribution of the shell molding process . . . yet without fast-setting phenolic resins to bond the sand, the entire process could never have been possible! Since first introduced, too, shell molding resin formulations have also undergone self-transition periods of change and betterment.

Today Catalin Resin 9616, a two-stage, powdered phenol-formaldehyde resin, emerges as the very latest and best type of formulation.

This economical resin produces high-speed curing rates with the minimum of resin content. Savings are achieved in time, sand, work space, handling and metal. Castings are more accurate and smoother – require considerably less finishing.

In addition to Shell Molding Resin 9616, Catalin produces a wide range of core binding liquid resins and powders for the production of ferrous and non-ferrous metal castings.

Catalin representatives, familiar with the requirements of the foundry industry, are available for consultation. Samples on request! Write . . .

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE, NEW YORK 16, N. Y.

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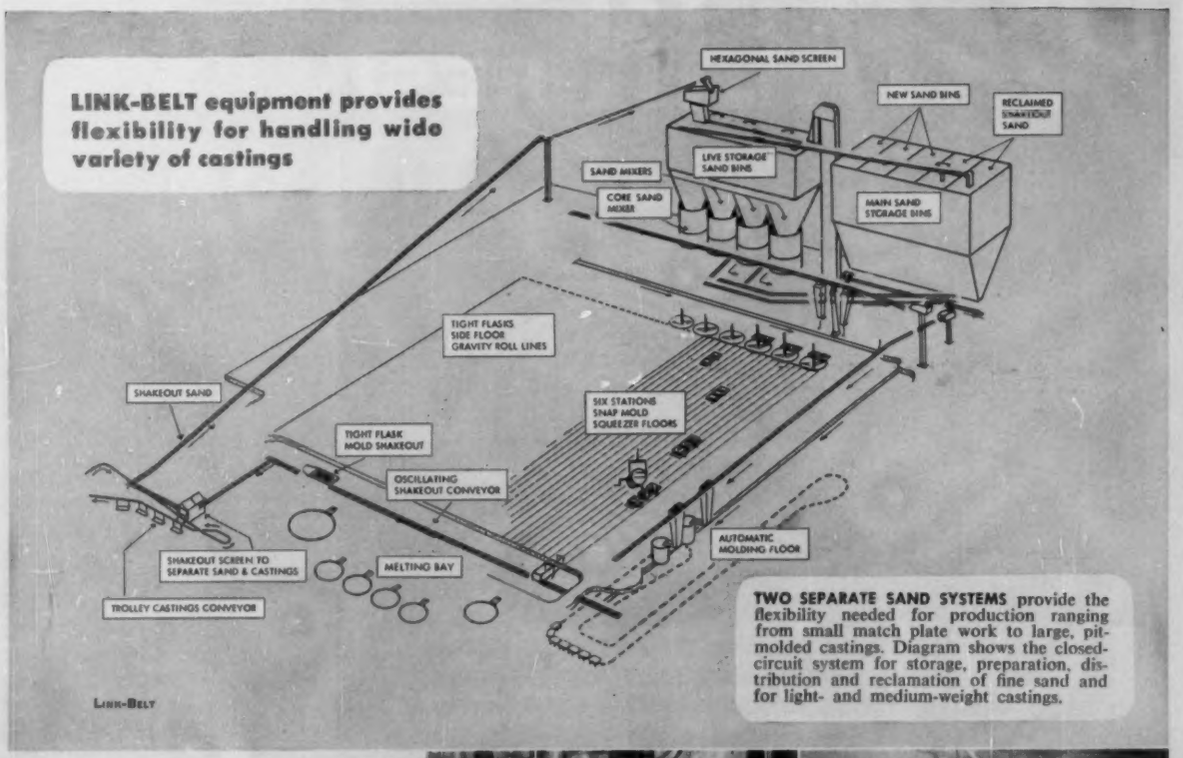
General Metals jobbing foundry approaches

full mechanization



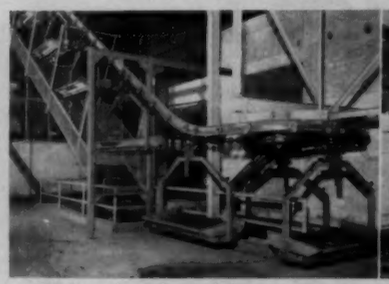
TWO SEPARATE SAND SYSTEMS provide the flexibility needed for production ranging from small match plate work to large, pit-molded castings. Diagram shows the closed-circuit system for storage, preparation, distribution and reclamation of fine sand and for light- and medium-weight castings.

THE variety of castings produced by job shops multiplies handling problems. But the Oakland (Calif.) plant of General Metals Corp. proves that mechanization is both possible and practical. Here Link-Belt equipment—including special machinery designed specifically for this installation—speeds production of castings ranging from one pound to seven tons. Other benefits include minimized manual handling, improved working conditions.

Link-Belt engineers can plan an entire conveying and sand preparation system for you . . . and follow through with a complete line of equipment to help you produce better castings at lower cost. For one machine or complete engineering, call your nearest Link-Belt office. For complete information, write for Book 2423. 14.207

Molds are loaded onto cars, which are rotated 90 degrees on turntable and run off on tracks to pouring and storage line.

Semi-automatic device dumps sand and castings onto oscillating conveyor. Cars return by gravity to molding stations.



Castings drop from shakeout screen to trays of overhead trolley conveyor for delivery to cleaning bay.

Unique Link-Belt "Manipulator" carries up to eight tons of castings to annealing ovens, quench tanks or storage.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

CIRCLE NO. 138, PAGE 21-22

Customer's Demands Theme Of Purdue Meeting

■ Meeting "The Customer's Demands" will be the theme of the Purdue Cast Metals Conference to be held October 25-26 at Purdue University, Lafayette, Ind., sponsored by the Central Indiana and Michigan Chapters of the American Foundrymen's Society and Purdue University.

Six technical speakers will participate in the two-day meeting

R. H. Greenlee

with Robert H. Greenlee, Auto Specialties Mfg. Co., Inc., serving as general chairman and C. O. Schopp, Link-Belt Company, as program chairman.

THURSDAY, OCTOBER 25

9:00 am . . . REGISTRATION

10:00 am . . . WELCOME ADDRESS, Dr. G. A. Hawkins, Dean of Engineering, Purdue University, *"The Future of the Foundry,"* James H. Smith, Central Foundry Div., General Motors.

1:30 pm . . . *"Pattern Design,"* Wm. Ball, Jr., R. Lavin Company.

3:00 pm . . . *"Meeting the Customer's Requirements,"* B. C. Yearly, National Malleable & Steel Castings Co.

6:00 pm . . . BANQUET. *Human Engineering in the Foundry,"* Victor L. Short, Institute of Human Science.

FRIDAY, OCTOBER 26

10:00 am . . . *"Concerning Sand,"* J. S. Schumacher, Hill & Griffith Company.

11:15 am . . . SHELL MOLDING PAN-

EL, V. J. Obrig, Central Foundries; J. C. Maggart, Sibley Foundry; O. C. Schopp, Link-Belt Company, T. E. Smith, Central Foundries.

1:30 pm . . . *"Can Casting Quality Be Improved?"* Ed Oakley, Delco Remy Division.

3:00 pm . . . CONFERENCE SUMMARY.

Teacher With Praise For Industry Donates 3 Books

Three additional books of historical interest on foundry practices have been added to the American Foundrymen's Society library as gifts of William L. Todd, retired foundry instructor of South Gate, Calif.

Mr. Todd entered the casting field as a youth attending the Wentworth Institute, Boston, Mass., and then worked in Massachusetts before moving to California in 1923. His employers prior to moving to California were Saco-Lowell, Lowell, Mass., J. H. Horne & Sons, Lawrence, Mass., Eagle Iron Foundry, Salem, Mass., Smith Iron Foundry, Lynn, Mass., Blake & Knowles Pump Works, Cambridge, Mass., and Davis & Luiber Machine Co., North Andover, Mass.

In 1938 Mr. Todd began as a vocational foundry instructor at Fullerton, Calif. and in 1941 transferred to Pasadena, Calif. He retired at the age of 60 on June 15, 1956 and plans to devote much of his time to travelling. In reviewing his career he says, "I still think that the foundry offers rich rewards to young men who are not afraid to work and are willing to accept the challenge."

The latest donations are *Brass and Iron Founder's Guide* by James Larkin published originally in 1892 and revised in 1907, *The Cupola Furnace* by Edward Kirk published in 1899 and *The Theory and Practice of Enamelling on Iron and Steel* written by Julius Grunwald in 1909, translated by Herbert H. Hodgson, and published in 1919.

These books were acquired by Mr. Todd from former friends, one a patternmaking instructor and the other a former bookkeeper who became a foundry foreman.

DIMENSIONAL ACCURACY...

obtained by Cooper Alloy

through SHELL MOLDING with G-E Shell Molding Resins

This stainless steel instrument housing, cast for a customer by Cooper Alloy Corporation, Hillside, N. J., was one of those "impossible" jobs. Previous experience by the customer had resulted in shrink defects in the lugs on the open face, rendering the castings unacceptable. The job was further complicated by the fact that dimensions and finish were equally critical on both exterior and interior surfaces.

Through shell molding and advanced foundry techniques, Cooper Alloy was able to convert this "impossible" job to a standard production run! Hollow shell cores achieved the required accuracy and finish for the casting's interior; the Shellcast* process accomplished similar results for the exterior. G-E shell molding resins helped Cooper Alloy obtain close dimensional accuracy, fine finish and uniform soundness.

How can shell molding help YOU?

Cooper Alloy uses *General Electric shell molding resins* in its Shellcast process, relying on them for batch-to-batch uniformity and correctly balanced properties. Other G-E products for shell molding include: *G-E silicone release agents* to release molds easily from patterns and *G-E phenolic bonding resin* to assemble shell halves together.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Ask G.E. about shell molding!

General Electric maintains a shell molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process. G.E. also offers a 28-page manual describing the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*

*Reg. trademark, Cooper Alloy Corporation

FREE SHELL MOLDING MANUAL!

General Electric Company
Section 6F482
Chemical and Metallurgical Division
Pittsfield, Massachusetts

Please send me a free copy of *G-E Shell Molding Manual.*
( ) We are presently using the shell molding process.
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CIRCLE NO. 139, PAGE 21-22

A bold and ambitious marketing program conceived by the Gray Iron Founders' Society is already launched and under way. An experienced industrial Marketing Director has been appointed to the Society staff. An aggressive Marketing Committee of member foundries has been organized. Extensive resources of the Society have been allocated to give the program broad scope.

This major effort will result in an accumulation of facts about Gray Iron markets and selling strategy never before available to gray iron foundries. *Initial studies are already in progress.*

- **Existing Gray Iron markets will be more precisely defined.**
- **Profitable potential markets will be uncovered.**
- **Strong and weak points of competitive materials will be analyzed.**
- **Research and product development will be geared to market conditions.**
- **Selling methods will be refined.**
- **Buying influences will be pinpointed.**

This new and continuing program will enable every Society member to cut a profitable slice of the Gray Iron castings market for himself . . . by helping him to make his marketing efforts more productive . . . by expanding the total consumption of Gray Iron.

Results of the marketing program will be presented to Society members in bulletins, at marketing seminars, local sales clinics and management meetings.

Join these progressive foundrymen. Write to the Society for information about membership. Gray Iron Founders' Society, Inc., Dept. M, National City-E. 6th Bldg., Cleveland 14, Ohio.

modern
Make it better with Gray Iron

GRAY IRON FOUNDERS' SOCIETY

CIRCLE NO. 140, PAGE 21-22

Look Into Castings Future Set for Michigan Meeting

■ Current casting problems and future developments will be covered at the Michigan Regional Foundry Conference to be held November 29-30 at the University of Michigan, Ann Arbor, Mich. The program will be sponsored by the Central Michigan, Detroit, Saginaw Valley and Western Michigan

Robert D. Dodge

Chapters of the American Foundrymen's Society and the University of Michigan and Michigan State College.

Conference chairman is Robert D. Dodge, Archer-Daniels-Midland Co., vice chairman and program chairman is Richard B. Kropf, International Nickel Co. The program will be held in the University of Michigan Union Building.

THURSDAY, NOVEMBER 29

9 am . . . Registration.

10 am to 12 am . . . First Session
"The Development of the Shell Cast Armasteel Crankshaft," C. E. Braun, Central Foundry Div., General Motors Corporation, *"Evaluation of Core Practice,"* Wayne Buell, Aristo Corporation, *"Diaphragm Molding,"* L. J. Pedicini, Research Div., General Motors Corporation.

12:15 pm . . . Luncheon. Toastmaster: Dean C. G. Brown, School of Engineering, University of Michigan.
"The Future of Castings in the Automobile Industry," M. F. Garwood, Engineering Div., Chrysler Corporation.

2:00 pm to 4:00 pm . . . Second Session

"Basic Lined Water Cooled Cupola," William Dawson, Ford Motor Company. *"Malleable Base Spheroidal Iron,"* E. F. Chojnowski, Albion Malleable Iron Company. *"Modern Brass and Aluminum Foundry Practice,"* R. A. Colton, Federated Metals Co.

6:15 pm . . . BANQUET. Toastmaster: Wm. W. Maloney, Secretary, American Foundrymen's Society. Speaker: C. L. Munn, Athletic Director, Michigan State University.

FRIDAY, NOVEMBER 30

9:00 am to 11:00 am . . . THIRD SESSION.
"The Foundry Outlook As Science Takes Over," Dean C. J. Freund, College of Engineering, University of Detroit.
"Manpower Maintenance," H. E. Gravlin, Jr., Claude B. Schneible Company.

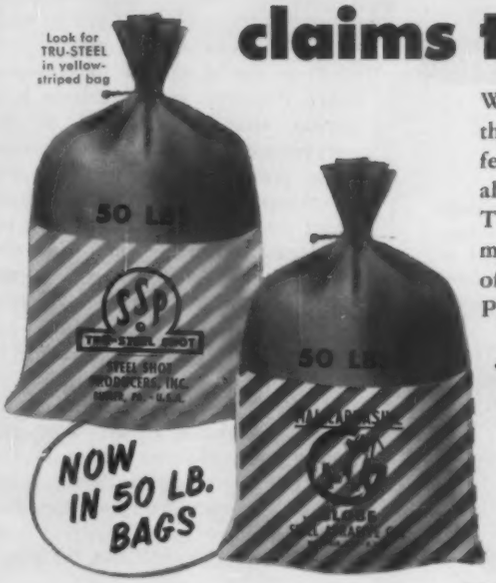
11:00 am to 12:30 pm . . . FOURTH SESSION.
"Automotive Gas Turbine Development," D. F. Frey, Scientific Laboratory, Ford Motor Company.

1:00 pm . . . LUNCHEON. Toastmaster: R. B. Kropf.

Following luncheon there will be student activities with C. Drury, Central Foundry Div., General Motors Corporation, acting as chairman.

Does this mean you quit?

Don't talk fancy claims to him!



When it comes to abrasives, a foundryman needs to know two things. How does it clean? What does it cost in operation? Different jobs may require different abrasives but the result should always be the same—a *good* job at *lowest cost.* Malleabrasive and Tru-Steel abrasives give you that. Whichever you need, Pangborn makes sure you get the right abrasive for every job. Talk to one of our sales engineers or order from Pangborn Corp., 1300 Pangborn Blvd., Hagerstown, Md.

1A

Pangborn DISTRIBUTORS FOR
MALLEABRASIVE® AND
TRU-STEEL SHOT

CIRCLE NO. 141, PAGE 21-22

STOP BLOW-BY with Dike-O-Seal®

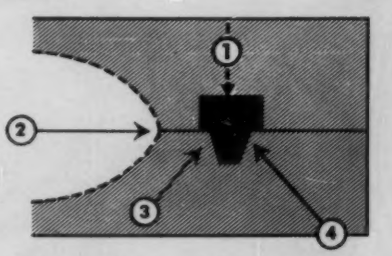
PATENTS APPLIED FOR

"Dike-O-Seal is the biggest improvement to core blowing since the inception of the core blowing machine"

General Foreman of large automotive pattern shop.

WHAT DIKE-O-SEAL DOES

Because Dike-O-Seal (1) is molded in its own container, it fits perfectly, bonded to every contour, cavity perimeter, loose piece and insert, giving metal-to-metal contact regardless of its complexities. Since it is flexible and because of its unique design, the higher the blow-in pressure (2) the more positive the seal. Pressure acting against the interior of the dike (3) creates static back pressure on the reverse side of the dike (4) positively preventing the escape of erosion-causing sand and air.



Dike-O-Seal can increase your production and lower your costs! This positive seal against parting line blow-by greatly reduces box maintenance and eliminates the necessity for steel or brass facings. Users report that Dike-O-Seal stabilizes core blower performance, permitting more consistent box venting practice which results in better core density control. The elimination of mudding, patching, ratting and finning saves labor costs and consistently produces better cores. The elimination of erosion due to blow-by, the reduction of "down" time, and the extended core box life increases production and profits. See how Dike-O-Seal can help you.

Send for Bulletin =56 and report on stopping BLOW-BY

Dike-O-Pad

FIRST AID FOR CORE BOXES

Dike-O-Pad, the revolutionary new pressure sensitive abrasion resistant pad, has been designed specifically to prevent erosion under blow-tubes. Original application and replacement is so simple there is no need to remove the core-box from production and yet the pads will withstand many thousand blows. They are now saving money for foundries everywhere. Write for price list and samples.

Dike-O-Seal® INCORPORATED

Main Office and Plant

Phone PR 8-2878 • 1209 W. 59th ST., CHICAGO 36, ILL.

CIRCLE NO. 142, PAGE 21-22

the SHAP of things

safety, hygiene, air pollution control

by Herbert J. Weber

Some time ago I was called into a brass foundry to see what could be done about preventing lead poisoning. The plant physician couldn't understand why there were cases of lead poisoning in the shop since he already had inaugurated a lead control program.

When I inquired about the control program, I learned that it consisted of the following set of "hygiene" rules:

1) Chewing tobacco or snuff was forbidden during working hours.
2) Smoking was forbidden in the plant.
3) Employees were required to wash their hands before lunch.

When I walked through the plant it was unbelievable that the obvious trouble had been overlooked and that real hygiene measures had not been applied. The ventilation was inadequate and the housekeeping bad. The plant "hygiene" rules were futile in such a situation.

Because of many similar experiences over the years, I have been prompted to start this column, which will appear regularly in each issue of Modern Castings.

It is the intention to consider such things as siderosis from iron oxide, aluminum therapy in the prevention of silicosis, respirators, lead poisoning, wetting agents, workmen's compensation, radiant heat, air pollution, safe practices, legislation affecting foundries, etc.

From inquiries received at the AFS headquarters it appears that many foundries have safety, hygiene and air pollution problems in common and some have found satisfactory solution to these problems. A column of this type can serve as a clearing house to the mutual advantage of all.

For example, if one foundry had unsatisfactory results with a particular type of ventilation for a specific application, it seems absurd that the same mistake should be duplicated by others. Also if a foundry has developed a better safety device, it would be a worthwhile contribution to the industry to tell others about it. In matters of safety, hygiene and air pollution control, foundrymen should share their knowledge even with their heaviest competitor. This is so not only because human beings are involved but also because we are classified together anyway for the purpose of fixing workmen's compensation rates and we are considered as a unit when the states write health and safety codes.

Thus by helping a competing foundry in matters of SH&AP we help ourselves. It is our hope that our readers will use this column as a means of exchanging information.

We intend also through the medium of this column to keep foundrymen informed of current legislation affecting our industry.

For example, the new Chicago Zoning Ordinance, if passed, will affect every foundry in the city. Some of the features of the ordinance are:

1) The total net rate of emission from all sources within the plant property shall not exceed 8 lb. per hour per acre of property.
2) The highest sound level permitted along an industrial district boundry line is 79 decibels.
3) The emission of odorous matter in such quantity as to produce a public nuisance beyond lot lines is prohibited.

There is a strong possibility that this ordinance will be passed before January 1.

Current events of this kind, we believe, are sufficient reason alone to justify the column. We hope you will make it yours. We would like to know too what you think of the idea.

Knock Out Pinholes

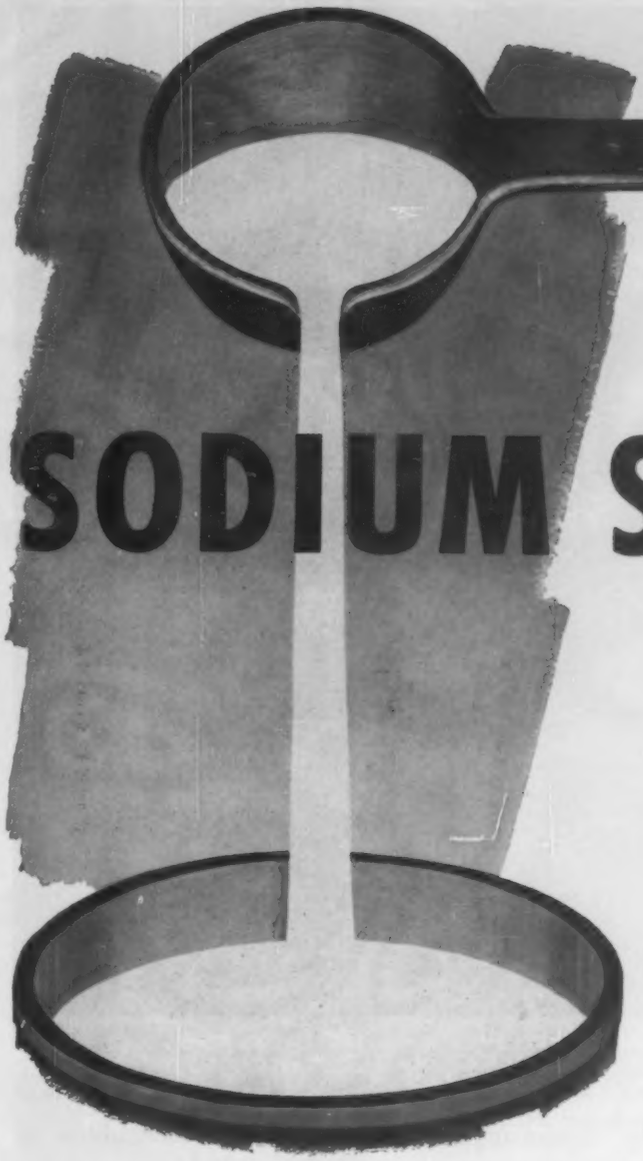
■ The sub-surface pinholes sometimes found in magnesium-treated nodular iron castings can be eliminated according to a study by J. Gittus, of the British Cast Iron Research Association. The defect appears to be most pronounced in green sand molded castings and can be alleviated both by additions of carbonaceous materials to the sand mixes and by small additions to the metal of aluminum, tellurium, and bismuth. A cerium addition is made to cancel any harmful effect due to these latter elements.

Experiments comprising major changes in sand composition showed that both synthetic sand and natural sands produce pinholing as revealed by shot blasting. The defect is independent of grain size and clay type. Also, no great influence in suppressing pinhole formation occurs when nodular iron is poured into dry sand molds.

To determine the effect of the metal on pinhole formation, 12 in. x 9 in. x 1 in. plates of magnesium free and magnesium treated iron were poured into molds made of synthetic and natural sands. Only when either sand contained 2 per cent pitch or 6 per cent coal dust was the reduction of pinholing significant. Lesser amounts of these materials did not reduce the pinhole formation appreciably.

Casting magnesium-treated metal into dry sand molds (either synthetic or natural sands) reduced pinholing. Magnesium additions of lesser amounts than that required for nodular castings reduces pinholing; ladle additions to nodular iron of more than 0.002 per cent tellurium, 0.004 per cent bismuth, or 0.2 per cent aluminum also eliminates pinholing. A pitch mold wash likewise was found to inhibit pinhole formation. Light thin-walled castings show less tendency for pinholing than heavy castings. Pouring speed variations do not effect pinholing and ladle additions of tin and zinc were ineffectual.

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 21-22.



FOR CO_2 PROCESS

DU PONT

SODIUM SILICATE

AVAILABLE IN TANK CARS, TANK TRUCKS AND DRUMS

Low in cost—consistently high in quality, Du Pont Sodium Silicate meets the exacting standards of precision foundry work.

Sodium Silicate is shipped from four Du Pont plants strategically located to serve you.

For further information, call or write our nearest office.

GRASSELLI CHEMICALS DEPT.
E. I. du Pont de Nemours & Co. (Inc.)
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DU PONT
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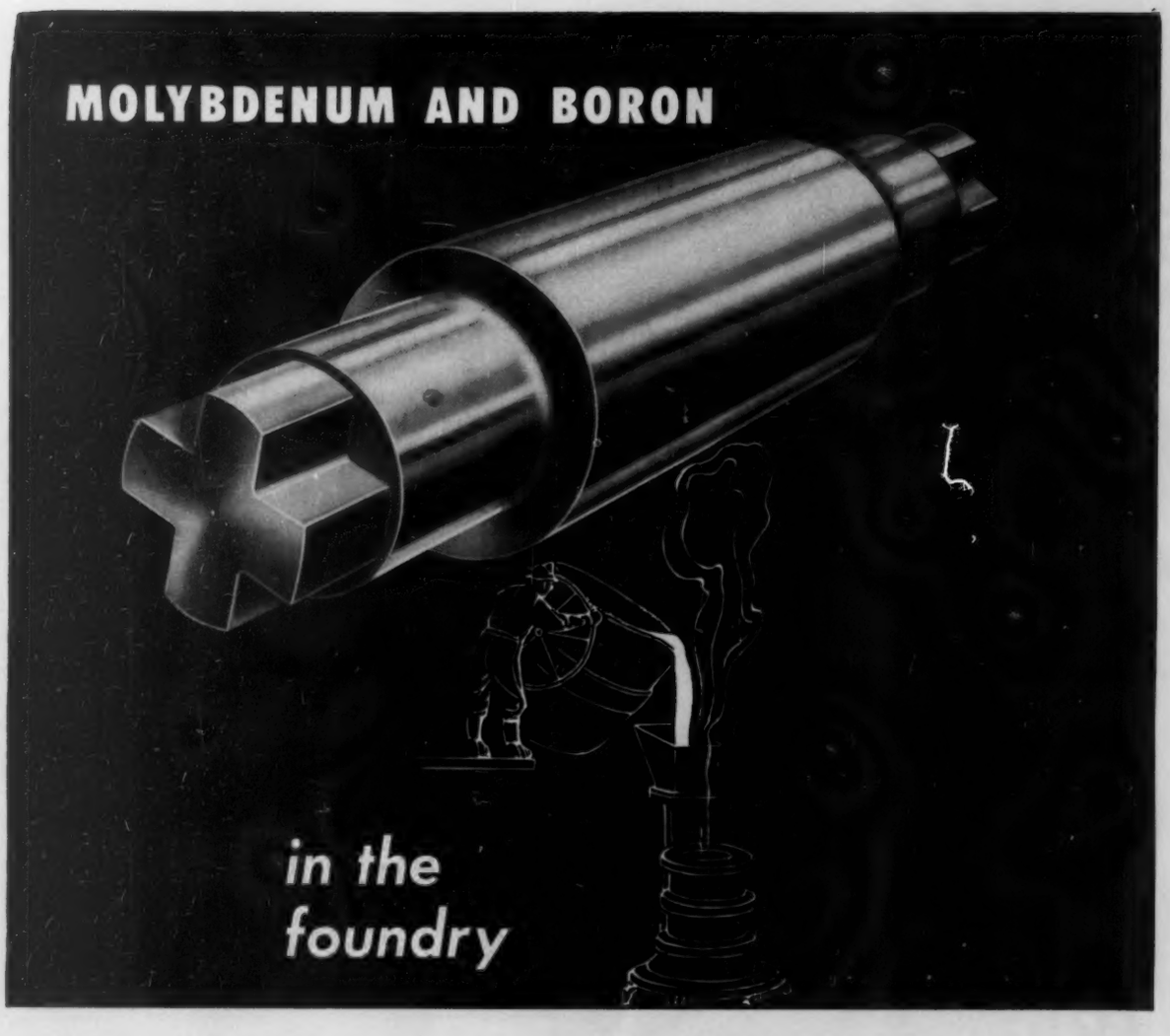
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

CIRCLE NO. 143, PAGE 21-22



Rolls are among many cast, wrought iron and steel products that have been improved by Molybdenum and Boron. Very small additions, properly introduced, yield surprising results. MCA Molybdenum additions increase the resistance of rolls to breakage, chipping, heat checking and spalling in service. Molybdenum and Boron improve toughness and hardness qualities at both room and higher temperatures.

Similarly, Molybdenum and Boron are effective in improving toughness and hardness in both light and heavy iron and steel castings.

As recognized authorities in the application of Molybdenum, Tungsten, Boron, Cerium and its derivatives both as alloys and chemicals, MCA assures confidential and immediate reponse to inquiries.

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Subsidiary: Cleveland Tungsten, Inc., Cleveland Plants: Washington, Pa., York, Pa.

MCA

CIRCLE NO. 144, PAGE 21-22

Announce Regionals

Ten regional conferences have been announced by the American Foundrymen's Society. Dates, locations and sponsors are:

Oct. 19-20 . . *Northwest Regional Foundry Conference,* Benjamin Franklin Hotel, Seattle, Wash., sponsored by Washington, Oregon, and British Columbia Chapters and the Oregon State College Student Chapter.

Oct. 19-20 . . *New England Regional Foundry Conference,* Massachusetts Institute of Technology, Cambridge, Mass., sponsored by New England and Connecticut Chapters.

Oct. 25-26 . . *Purdue Metal Casting Conference,* Purdue University, Lafayette, Ind., sponsored by Central Indiana, Michiana Chapters and Purdue University.

Nov. 8-9 . . *All-Canadian Regional Foundry Conference,* Mt. Royal Hotel, Montreal, Quebec, sponsored by Eastern Canada and Ontario Chapters.

Nov. 29-30 . . *Michigan Regional Foundry Conference,* University of Michigan, Ann Arbor, Mich., sponsored by Central Michigan, Western Michigan, Detroit and Saginaw Valley Chapters and Michigan State College and University of Michigan.

Feb. 14-15 . . *Wisconsin Regional Foundry Conference,* Hotel Schroeder, Milwaukee, sponsored by Wisconsin Chapter and University of Wisconsin Student Chapter.

Feb. 21-22 . . *Southeastern Regional Foundry Conference,* Dinkler-Tutwiler Hotel, Birmingham, Ala., sponsored by Birmingham and Tennessee Chapters and University of Alabama Student Chapter.

March 15-16 . . *California Regional Foundry Conference,* Claremont Hotel, Berkeley, Calif., sponsored by Northern California and Southern California Chapters.

April 12-13 . . *East Coast Regional Foundry Conference,* Philadelphia, sponsored by Philadelphia,

Metropolitan and Chesapeake Chapters.

June 20-22 . . *Penn State Regional Foundry Conference,* Pennsylvania State University, University Park, Pa., sponsored by Rochester, Pittsburgh, Metropolitan, Eastern New York, Western New York, Northwestern Pennsylvania, Central New York, Chesapeake, Philadelphia Chapters and Reading Foundrymen's Association, Conestoga Foundrymen's Association, Pennsylvania State University Student Chapter.

Schedule Metals Shows

Metal working and finishing will be the theme of two shows to be held this fall and winter. The Metal Finishing Show will be held October 30-Nov. 2 in Cleveland and the 10th Western Metal Congress and Exposition will be held March 25-29 in Los Angeles.

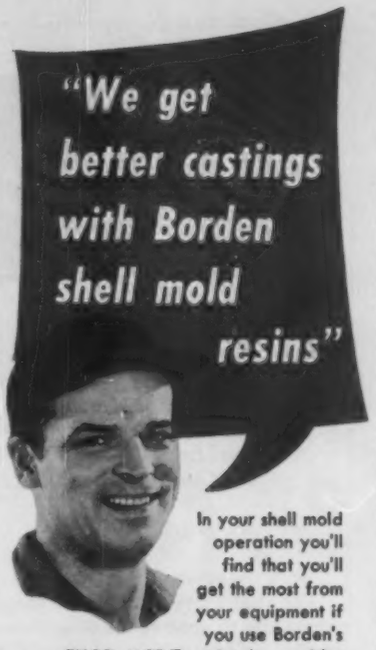
More than 35 manufacturers of equipment utilizing coated abrasives for grinding and polishing are expected to exhibit in Cleveland. Machines will range in size from heavy automatic and semi-automatic grinders to equipment used in small radius contours and in capacities from those removing 0.100 in. per pass to precision polishers.

In Los Angeles, the Congress will be sponsored by the American Society for Metals. Last year 53,000 spectators saw more than 440 exhibits and initial inquiries indicate a larger show for this year.

Holding associated technical sessions with the A.S.M. will be The Welding Society, the Nondestructive Testing Society and the American Institute of Mining, Metallurgical and Petroleum Engineers, Metals Division.

Looking . . .

. . . for new production ideas? Circle numbers on Reader Service cards (page 21-22) to get more information on products and services described in Products & Processes and For the Asking.



In your shell mold operation you'll find that you'll get the most from your equipment if you use Borden's THOR MCF-7 resin. It provides full-thickness build up, even on angular and vertical pattern surfaces . . . and it helps produce a flat, rigid shell without warpage that strips off the pattern cleanly and easily.

To get better castings, let a Borden foundry engineer set up a trial run of Borden's THOR MCF-7 resin. Write The Borden Company, Chemical Division, Foundry Dept. MCA-106, 350 Madison Ave., New York 17, N. Y.

Urea • Phenolic and Oil Soluble Resin Core Binders Shell Mold Resins • Core Spray Core Paste • Parting Agents

FOUNDRY RESINS

THE Borden COMPANY CHEMICAL DIVISION

Cost Figures Prove New Core-Curing Technique Economical and Time-Saving

New York, N. Y.—An important announcement came today from the Foundry Department of The Borden Company, Chemical Division, concerning Borden's new heated-air process for curing cores in the core box. Mr. Donald J. Murray, Foundry Department Manager, made available for the first time cost-figures and time-saving estimates showing the high efficiency of this technique that involves blowing a stream of heated air through a properly vented box to bake the core to exact core-box dimensions, while assuring smooth, clean castings.

Tests Prove Economy

The results of tests by Borden Engineers, showing the efficiency with which air is heated in the new Borden process, were revealed in detail. In the tests, the sand mix used consisted of 1000 parts of Wedron AFS-70, 20 parts of urea resin FB-24 (1% solids), and 10 parts of water. Power required to heat 8,000 cu. ft. of air to 100° in a GCH-34 Heater is 4.5 kwh. The power cost for the first 4,000 kwh was found to be only $0.017 and the power cost to dry one pound of core from a 2% moisture content was a mere $0.00022.

Time-Saving Example Cited

Mr. Murray also revealed that this new process dries cores in a fraction of the time required in ovens. This example was given: A seven pound circular core, two inches thick, made from core sand ASF-70, completely dried and cured in *one* minute in the core box with cold-air pressure at 20 psi. and hot-air temperature at 400°F. using a one-half inch pipe connected to the heater and to the core box manifold.

Full Information Available

Foundry operators interested in this technique can obtain full information from Borden, Mr. Murray stated. Write to the Borden Company, Chemical Division, Foundry Department MCA-106, 350 Madison Avenue, New York 17, N. Y.

"This new Borden Core-Curing Technique is so efficient our men only have to take an occasional 'work break!'"

CIRCLE NO. 145, PAGE 21-22

Foundry operators are discovering that they get clean, smooth, hard cores when they use Borden resin core binders. Binders that help speed production through faster baking . . . assure easier shake-out . . . contain no volatiles to gum up oven interiors . . . and eliminate smoke so working conditions are better.

Perhaps a Borden core resin can help solve some of your foundry problems. Contact us today for a trial run with a Borden foundry engineer to assist. The Borden Company, Chemical Division, Foundry Dept. MCA-106, 350 Madison Ave., New York 17, N. Y.

Urea • Phenolic and Oil Soluble Resin Core Binders Shell Mold Resins • Core Spray Core Paste • Parting Agents

FOUNDRY RESINS

THE Borden COMPANY CHEMICAL DIVISION

A HOT SUBJECT:

CASTING URANIUM

Foundrymen may have answers needed to get nuclear power plants into economical operation.

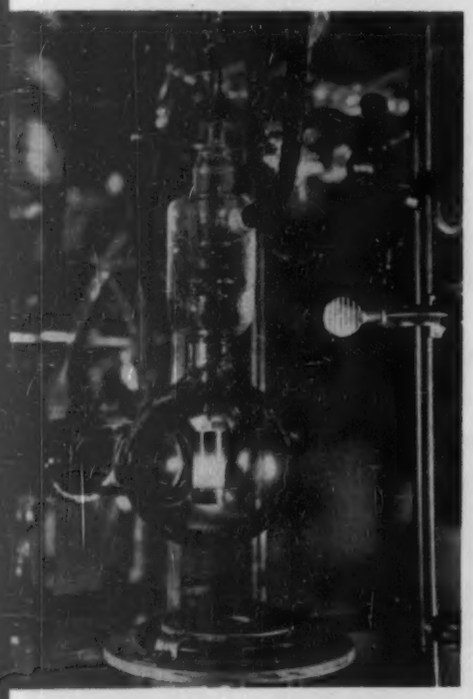
F. L. CUTHBERT /
Technical Director

W. E. SHAW /
Asst. to Tech. Dr.
National Lead Co. of Ohio
Cincinnati

Fuel for nuclear power plants must soon be one of the products of casting technology as the power industry turns to nuclear reactors using cast uranium as fuel.

Large tonnages of the nuclear metal, uranium, cast into fuel shapes for reactors can be forecast as a requirement for the near future, and the speed with which nuclear power becomes competitive to power generated with coal or oil will depend on the ability of industry to cast and fabricate the metal for the reactors.

Atomic metals production is moving from tiny lab furnaces into high production melting.



Although the production of uranium has been a relatively small-scale operation, it has been melted and cast in tonnage quantities for the past fifteen years and larger tonnages are indicated by the power industry demands.

Uranium is unique in many respects but it can be handled by techniques familiar to many foundrymen. Perhaps not many foundrymen have yet had an opportunity to tackle problems in casting uranium, but more problems will be finding their way into more foundries. The information presented in this article has been assembled because of its general interest to the castings industry and because of increasing participation by private industry in Atomic Energy Commission activities.

Physical Properties

One of the outstanding properties of uranium is its density, being almost twice as great as lead (Fig. 1.). Density values for uranium have been reported ranging from 18 g/cm³ to higher than 19 g/cc. The most reliable figure being 19.05 g/cc.[1] Extremely minor amounts of impurities, measured in parts per million, affect the density and this relationship is so significant that density can frequently be utilized as an indication of purity.

The hardness of cast uranium compares to that of some stainless steels. Values ranging from 85 to 100 on the Rockwell B scale have been obtained. Heat treatment and quenching affects the hardness of uranium in much the same manner as other metals. The material is subject to work hardening by typical industrial practices such as rolling, forging, extrusion or swaging.

Considerable information has been published on the crystal structure of uranium.[2] Much of the earlier data has been disproved and the present accepted concept is that alpha uranium has an orthorhombic crystal structure while gamma uranium is cubic. The structure of the beta phase is considered to be tetragonal.[3] The transition from the alpha phase to the beta phase occurs between 655 and 673 C, while the transition from the beta to gamma phase occurs between 765 and 785 C.

A great range in melting points has been reported in the literature, with much of the variation ordinarily being caused by varying degrees of purity. Probably one of the best substantiated melting points is 1133 ± 2 C.[4]

Melting and Casting

A wide variety of furnaces may be used for melting uranium; however, because of its pyrophoric nature and the fact that it is readily oxidized, it is most common to melt in a vacuum induction furnace. Arc melting techniques, using both consumable electrodes and tungsten arc electrodes, may also be used. A schematic cross section of a vacuum induction furnace which could be used to melt uranium is shown in Fig. 2. The furnace consists of two sections: the upper part or body, having a platform on which the crucible and coil are mounted and through which a pour mechanism may be activated; the lower section, or mold tank, contains the mold which is centered under the pour spout of the crucible.

Special grades of graphite are commonly used as crucible material. However, other materials, such as thoria and beryllia, can be used if necessary. Crucible coatings are frequently used to protect the melt from contamination with crucible material. These coatings, of a refractory nature, can be applied in the form of a slurry by any of the common industrial methods; spraying, painting, etc., and must be thoroughly dried before the crucible can be used.

Stopper rods and knock-out plugs are used to plug the tap hole in the crucible and are removed when the melt is ready to pour. Because of the high density of the metal, the mold is subject to much erosion and mechanical damage and must be built in a sturdy manner to prevent failure of the mold components.

It is usual to cast ingots in these

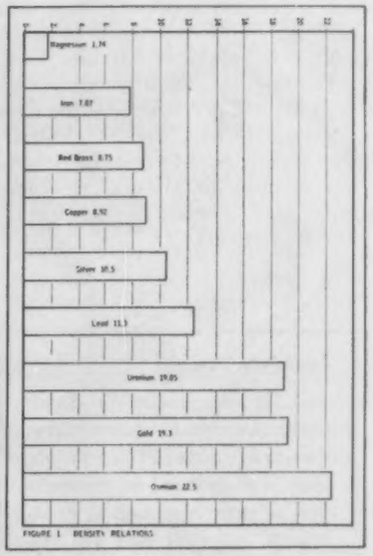


Fig 1. Density shows purity.

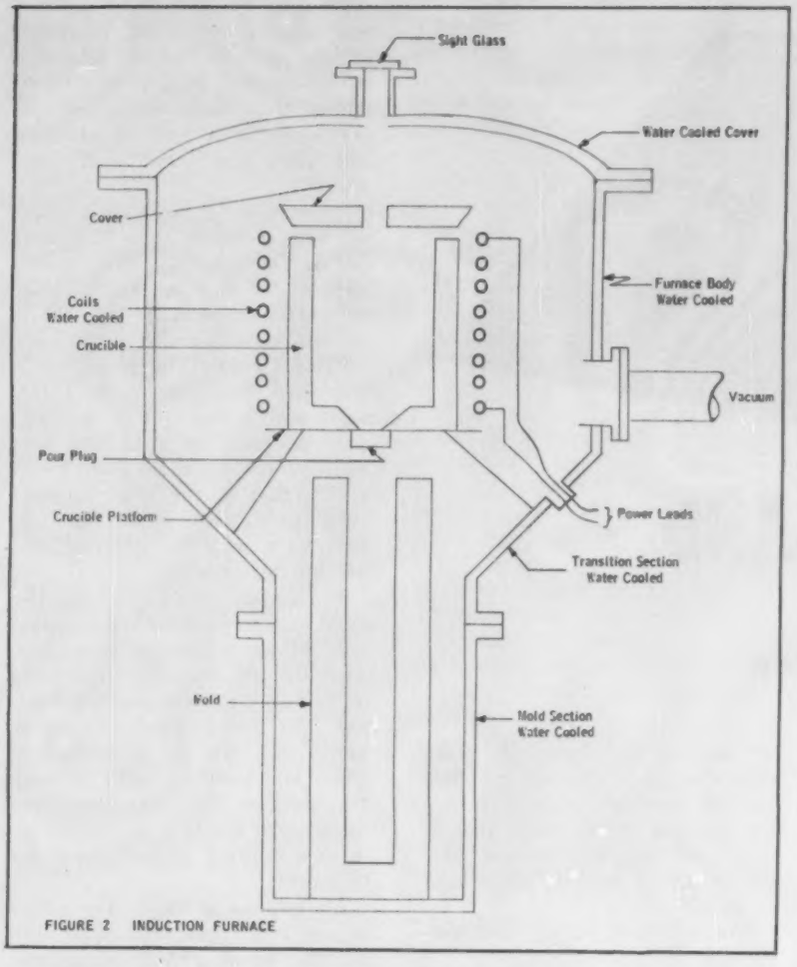


Fig 2. Production melting furnaces for uranium are water-cooled vacuum induction furnaces built in two sections with the crucible and coil contained in the top section and the mold in the lower.

molds that later can be reduced by rolling to desired shapes. The molds for ingots are generally of a cylindrical shape with the parting being either horizontal or vertical, Fig. 3. Other shapes may, of course, be cast and these shapes are generally cast in graphite molds that have been machined to form the desired cavities.

Machining of the graphite is quite similar to the machining of metals. Tool wear and ventilation are two of the major problems that arise. If the usual metal working equipment is available at the foundry, competent personnel can produce almost any shape in graphite.

Graphite is not the only material for the construction of molds. In addition, molds may be made of iron or copper. However, some rather careful preparation and handling must be undertaken to handle this heavy, high-melting metal. The foundryman's experience in the handling of other metals is extremely useful in the handling of uranium.

In the design of molds much care must be given to the shrinkage properties of uranium. In going from the liquid to solid alpha phase, an overall volume decrease of approximately 4 per cent is obtained. Dependent upon the manner of cooling, additional difficulties may be caused by anisotropic shrinkage. Through the range 25-300 C, the following co-efficients of expansion are reported:[5]

Direction Parallel to Axis	Average Expansion Co-efficient $10^6 Cm/C$
a [100]	23 ± 3
b [010]	-3.5 ± 2
c [001]	17 ± 2

This data giving negative results in one direction and positive values in the other indicates the type of difficulty that can be encountered in the casting of uranium.

Though the preceding section emphasized the static casting of uranium in a vacuum, the metal may be melted and cast under inert gaseous atmospheres or slags. It can also lend itself to the techniques of centrifugal casting. In fact, the high density of the material might be a decided advantage in the casting of uranium by centrifugal casting techniques.

There should be one point emphasized in the discussion of melting and casting of uranium. That point is purity. A typical analysis of uranium that may be used for reactor fuel is shown in Table 1.[6] Materials which have a high capture cross section or an ability to grab neutrons readily, such as the rare earths, or boron, or cadmium, or hafnium, must be kept out of uranium if it is to be used for nuclear purposes. The presence of absorbed gas in the metal also can be extremely undesirable. This could cause considerable radioactivity in the coolant and necessitates shutting down the pile or reactor, an extremely expensive operation.

TABLE 1. TYPICAL ANALYSIS OF URANIUM METAL FOR REACTOR FUEL

Element	*ppm*	*Element*	*ppm*
Carbon	40	Chromium	5
Iron	28	Mg	5
Al	20	Ni	5
O_2	16	Cu	3
Si	10	Mo	1
K	10	Pb	1
Mn	8	Ag	0.5
N_2	7	B	0.2

Alloys

The actual use of uranium in nuclear equipment in the immediate future will most probably be in the form of alloys. These alloys are required for corrosion resistance and desirable mechanical properties, as well as nuclear physics requirements.

Uranium will alloy with elements such as zirconium, aluminum, niobium, molybdenum, etc. These alloys can be prepared by mutual co-reduction of the alloying agent and uranium, or they can be prepared by addition of the element or master alloy to uranium. Much effort should be expended along these lines to develop good industrial alloying procedures.

Future

The present skill of the foundryman and his ability to handle new problems and develop new techniques should lead to the production of low-cost, physically sound fuel shapes that require a minimum of machining, suitable for use "as cast" in the economical reactor of the future.

Bibliography

(1) *The Chemistry of Uranium, Part 1.* J. B. Katz and Eugene Rabinowitch, McGraw-Hill Book Co., Inc., 1951

(2) 1930 J. C. McLennan and R. W. McKay, Trans. Roy.Soc.Can.(3) 24,III:1
1933 T. A. Wilson, *Physics*, 4: 148; Phys. Rev. 43:781
1937 C. W. Jacob and B. E. Warren, *J. Am. Chem. Soc.*, 59:2588

(3) *Reactor Handbook, Vol. 3, Sec. 1*, General Properties of Materials, USAEC, AECD-3647

(4) A. I. Dahl and H. E. Cleaves, *J. Research Natl. Bur. Standards*, 43:513

(5) Battelle Memorial Institute Report CT-2002 (August 1, 1944)

(6) S. Glasstone, *Principles of Nuclear Reactor Engineering*, D. Van Nostrand Co., Inc., 1955

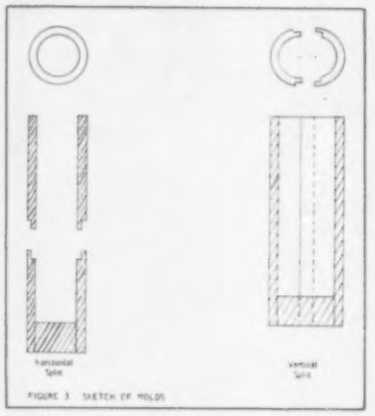
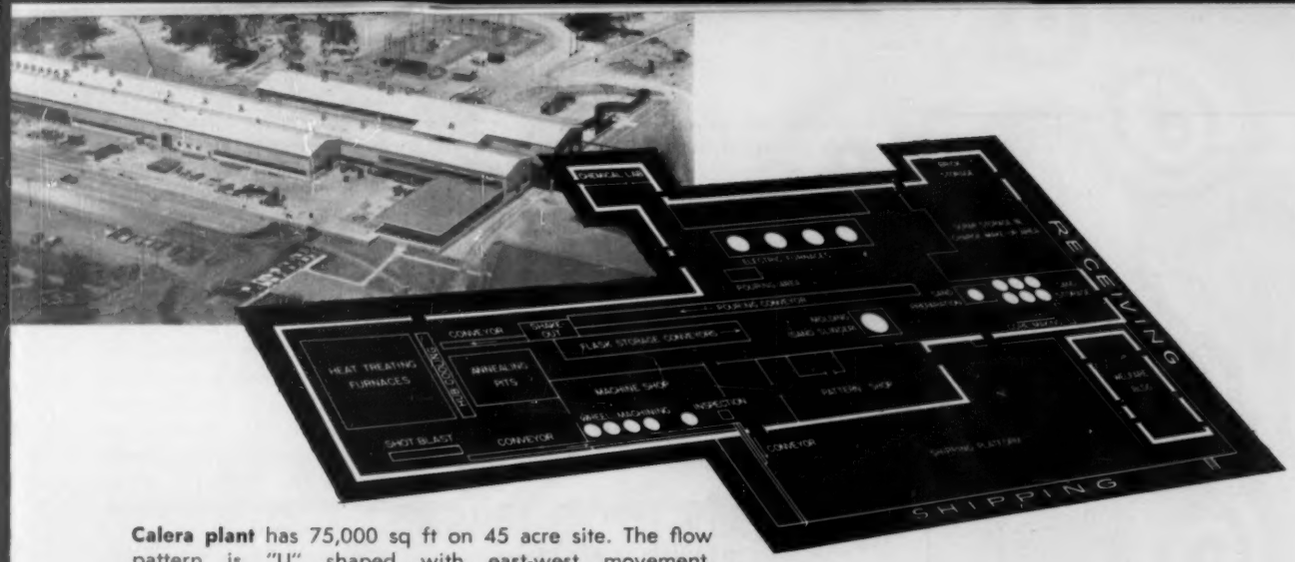


Fig 3. Uranium ingot molds.



Calera plant has 75,000 sq ft on 45 acre site. The flow pattern is "U" shaped with east-west movement.

STEEL WHEELS in GREEN SAND

Developing of new techniques has led to lowering costs and increasing production

LARRY DEBOER / *Metallurgist*
Southern Wheel Div.
American Brake Shoe Co.

The blast of the diesel horn and the thunder of steel wheels racing over steel rails are the keynotes of modern, high-speed railroading. Wheels that can move ever greater loads at ever increasing speeds have been the subject of 13 years of research by the Southern Wheel Division of the American Brake Shoe Company. The result of this research was the construction of a four million dollar plant that is now producing high carbon steel wheels with a modern green sand technique.

Wear-resistant 1.5 per cent carbon wheels are being produced at this plant in Calera, Alabama, by economical sand casting techniques that have controlled the previously high cost of cleaning and correcting sand cast steel wheels.

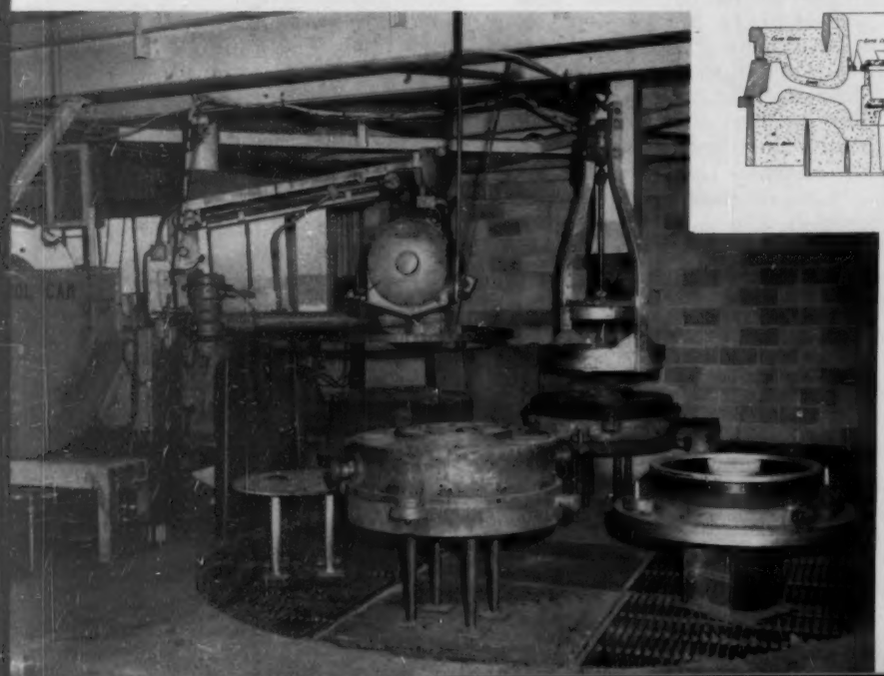
Production at the Calera plant has been increased from 12 wheels per day in February, 1954, to 384 wheels per day in March, 1956. Present production is 384 wheels per day, enough for 48 freight cars.

Plant Layout. The plant has a floor area of approximately 75,000 sq ft and is laid out in an east-west direction on a 45 acre site. The flow pattern in the plant forms a "U", that is, the raw materials enter the east end of the building, flow west into the molding and melting departments.

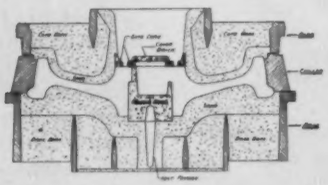
From this point, the poured mold moves west into the shake-out; and the pits for self-annealing. After the pits, the wheel continues on to heat treatment and hub cooling. The semi-finished wheel now moves east into the cleaning machine and continues east through the machine shop and inspection department where it finally emerges as a finished product ready for shipment.

Description of Mold. The wheel is cast in a green sand mold with a chiller forming the tread surface. The flask equipment is composed

Molding station consists of turntable with 6 positions.



Mold used in casting steel wheels.



Headbreaking operation separates riser from the wheel.

of three parts: cope, chiller and drag. The cope and chiller are bolted together, handled as a unit, and will be referred to as the cope. The function of the chiller is dual in that it gives the tread metal a fine as-cast grain structure as well as promoting directional solidification. It is necessary to solidify the massive tread section before the web freezes because the only riser on the casting is above the hub of the wheel. The order of solidification must be, first, the tread section, then the thin web followed by the hub and finally the riser.

The riser feeds the casting and also acts as a pouring basin. Therefore, it was necessary to design an unusual set of cores to allow large feeding gates as well as a choked pour. A center or hub core was designed with three large feeding gates which are connected to the riser by a large hole in the center of the gate core. This hole is covered during pouring by a circular brick so that the steel will enter the mold through twelve small pouring gates evenly spaced about the large feeding gate.

These small "pop" gates make it possible to obtain a controlled choked pour. After the mold cavity and riser are filled, the brick floats to the top of the riser, opening the feeding gates and allowing the molten steel to feed the casting.

Molding. Washed and dried 50 AFS grain fineness silica sand is received in box cars and unloaded by a tractor shovel into one of four sand storage tanks. As new sand is required, it is blown through a pipe to the new sand service tank over the mullers. From this tank, the new sand can be used in either the molding or core sand mullers.

The core sand is prepared in a small 750 lb capacity muller with weighed amounts of additions and a phenolic resin binder. Both center and gate cores are blown, and then baked in a continuous dielectric oven. As the cores are discharged from the oven, they are stacked in tote boxes and moved by lift truck to the molding area. No storage area was provided as the cores are used as soon as they cool.

The molding sand is mulled in 1750 lb batches. Above the muller are located three return sand tanks as well as a new sand tank. Sand is conveyed from the tanks to a weigh hopper above the muller by vibrating feeders. Probes in the weigh hopper relay temperature and moisture content to an electronic moisture control unit. This unit automatically adds the proper amount of water to give the per cent moisture required. Binders and additives are weighed and charged into the muller through a side charging door.

Both the facing and backing sand contain large amounts of return sand. Carbonaceous materials and cereals, as well as western bentonite, are added to facing mix while only western bentonite is added to the backing. Sand tests are made as a routine check throughout the day to assure that the sand is under control.

After the sand has been mulled, it is moved by elevator and belts to the molding station. The molding station is a large turn-table on which are mounted six smaller turn-tables, carrying alternately spaced cope and drag patterns. In operation, the large table indexes one station at a time and remains in that position until work has been completed at all six stations. Basically, the six stations are as follows: drag flask on, cope flask on, add facing, ram, strike off, and strip.

Shakeout is operated by one man.

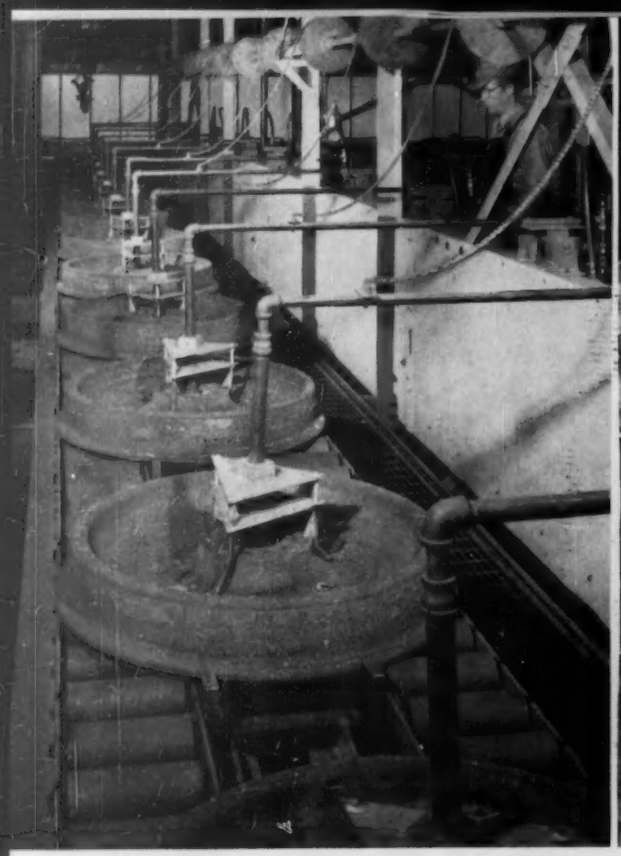
Red-hot wheels are put in insulated pits for crucial cooling period which relieves stresses and cools hub through transformation range.

Molds are rammed by a cam controlled, hydraulically operated automatic sand slinger. As the flask rotates, the slinger head moves from one position to another over the mold filling the flask to the required hardness. After ramming, the excess sand is struck off and the mold is stripped from the pattern. A monorail air hoist picks up the drag from the stripping pins and places it on the mold conveyor. The drags are set on cars and the center core set and gauged. Another air hoist is used to remove the cope from the turn-table and close the mold. The pouring brick is set over the feeding gate in the riser and the mold is ready to be poured.

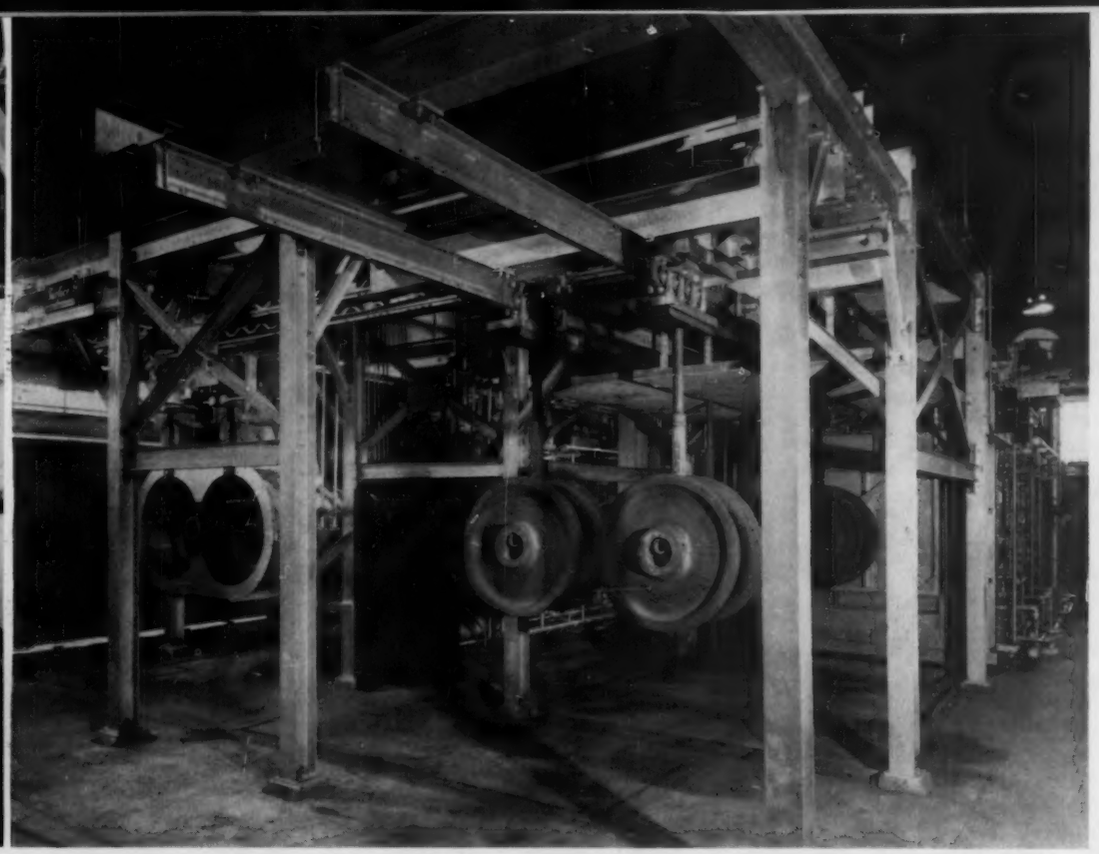
The conveyor which moves the molds through molding, pouring, and shakeout and which then returns the drag flask to the molding department is a pallet car type. Each pallet car holds three molds. Trackage for the cars consists of a parallel set of tracks connected on either end by a transfer car to make a complete circuit. The conveyor is powered by pneumatic pusher mechanisms which index the pallet cars one mold space at a time. The pusher mechanisms are arranged in several individual units so that the molding, pouring, and shakeout sections of the conveyor can be operated independently. This is necessary because the pouring is not continuous, but in heats of twelve wheels each.

Melting. Scrap storage bins, refractory storage, and alloy and flux storage are all covered and located along a spur track to cut down material handling distances. The scrap is received in gondolas and unloaded by a bridge crane. It is separated by analysis and stored in large bins on either side of the track. Brick and other refractory materials are usually palletized and unloaded by lift truck to their respective storage areas.

Four 9 ft, top charge, 3750 to 4000 KVA, basic electric arc furnaces are used to melt five to six ton cold charges. Only three are operated, the fourth is available during refractory maintenance. Normal melt-down time is 45 minutes while the overall time from charging to tapping is 60 to 75 minutes. Tapping temperature is



Cooling hub with water gives a stress pattern which enables wheel to withstand larger loads.



Heat treating is done in two stages: first, heating up to 1750 F and holding for two hours, then air cooling to 1200 F. Second, reheating to 1450 F and holding temperature for five hours.

approximately 3000 F.

After the charge is melted down and a temperature of about 2800 F has been reached, a preliminary analysis of carbon and manganese is taken. Depending on the results of this test, the operator makes the necessary adjustments in the bath. This may involve boiling the steel with ore or oxygen to reduce the carbon level, or charging pig iron to raise the carbon level. A second carbon prelim is taken, and if necessary a third and fourth. After the last check shows the chemistry to be in range and the bath temperature at approximately 3000 F, the melt is tapped into a teapot ladle. Ferro-silicon and petroleum coke are added to the ladle while the furnace is being tapped.

The tap temperature is read with an optical pyrometer to determine holding time in the teapot before the steel is reladled into a bottom pour ladle with capacity to pour four wheels. The temperature is checked in the bottom pour ladle with a platinum, platinum-rhodium immersion thermocouple connected to a recording instrument. A starting thermocouple temperature of 2800 F gives the desired results.

The bottom pour ladle is handled on a monorail bridge crane from the holding ladle station to the pouring station where it is centered directly above the pouring basin. The time to fill each mold is approximately eleven seconds and the overall pouring time for a heat of twelve wheels is 10 to 11 minutes in a temperature range of 2740 to 2800 F.

A final chemical test wedge and mechanical property test block are poured with each heat. The chemical test wedge is analyzed in the laboratory and the results reported to the metallurgist. The test block follows the wheels to shakeout and through heat treatment.

Shakeout. An important step in shaking out the wheel is "head breaking". The head or riser must be separated from the wheel after it has finished feeding the casting, but before it becomes solidly frozen to the hub. Approximately 50 minutes after pouring, a grab lifts the cope, shearing the riser from the hub. The cope is then set back on the drag and the mold moves to the shakeout unit.

Twelve to 14 minutes after "head break", the wheels enter the shakeout. One man operates the shakeout unit with a master control panel. A set of three grabs (one for the cope, one for the wheel, and one for drag) lifts the casting and the flask from the conveyor and into the shakeout. The cope, with the riser, is vibrated until clean, then moves out the back side of the shakeout, the riser dropping down a chute into a tote box. After the cope leaves the shakeout, it is automatically stacked in four high stacks on one of three cooling conveyors where it remains until the next day's work. The chiller, which is attached to the cope, must be at room temperature when used in order to derive full benefit of its chilling action for directional solidification.

The drag is vibrated until clean and returned to the conveyor to be reused that day. The majority of the sand is knocked off the wheel in shakeout, but it needs further cleaning. All of the center core sand must be removed from the bore to enable the feeding gates to be burned off without deflecting the flame into the hub. The fillets and plate of the wheel must have the excess sand removed as it would act as an insulator during heat treatment. This sand is removed in a cabinet located at the discharge of the shakeout. The center core is sand blasted out, while the fillets and plate are cleaned by flailing chains.

After the wheel is discharged from this cabinet, the three feeding gates are automatically burned from the bore of the wheel by an oxygen-natural gas torch. The circular movement of this torch is controlled by a cam with a power driven roller.

Pitting. The red-hot wheels are placed in insulated pits by a monorail crane for a minimum time of

5½ hours. The pitting operation serves a triple function: it allows the hub to cool down through transformation, gives a stress free wheel, and enables the wheel to be held at a temperature between 900-1200 F before charging into the heat treat furnaces. The as-cast structure is brittle and for this reason the wheel must be stress free and hot to withstand the thermal shock when it is charged into the heat treat furnace.

Heat Treatment. The wheels are moved from the pits to the heat treat furnaces by an overhead monorail cab crane. These cranes also handle the wheels when they are discharged from the heat treat furnaces and moved to the hub-cool conveyor.

The heat treatment of the 1.5 carbon steel wheel is done in one or two types of furnaces. There are two lines of car bottom batch furnaces and one continuous hanger furnace. All three units provide the same two stage heat treatment: first, heating the wheels to 1750 F. and holding that temperature for two hours, followed by an air cool to 1200 F.; second, reheating them to 1450 F. and holding that temperature for five hours.

This treatment changes the as-cast steel from a weak brittle material into a strong relatively ductile material. Metallurgically, it takes the long needle-like carbides which are in the as-cast grain boundries and disperses this carbide throughout the grains as small spheres. The treatment also refines the grain structure.

Temperatures are controlled in the various zones of the furnaces by thermocouples connected to recording control instruments. In addition, as temperature control is very important, check thermocouples are placed in various zones of the furnaces and their temperatures are recorded on a twelve point recorder.

Hub Cooling. After discharge, the wheels are allowed to cool below the transformation temperature. The hub is then cooled with a water spray. This treatment gives the wheel a preferential stress pattern that enables it to better withstand the loads received in service. By cooling the hub with a water spray, the tread, in effect, is shrunk onto the hub, that is, radial compressive stresses are set up in the hub fillet. The water spray does not harden the hub because the wheel is allowed to cool below transformation temperature before the water is turned on. Timing is important in hub cooling for two reasons: first, spraying the hub too soon would cause a hard bore and second, the delay and spray times effect the amount of stress induced into the wheel. For these reasons, timers have been installed to automatically turn the sprays on and off at the proper time. After the water spray, the wheels are allowed to cool on roller conveyors with pusher mechanisms. By the time the wheels reach the cleaning machine, they have cooled to 200 F or below.

Cleaning. The wheels are charged in a vertical position into a shot blast cleaning machine which cleans the sand and heat treat scale from the wheels. After the wheels are discharged from the cleaning machine, they are tipped back to a horizontal position and allowed to roll down a gravity roller conveyor to the machine shop. The wheels cool down to room temperature on this conveyor.

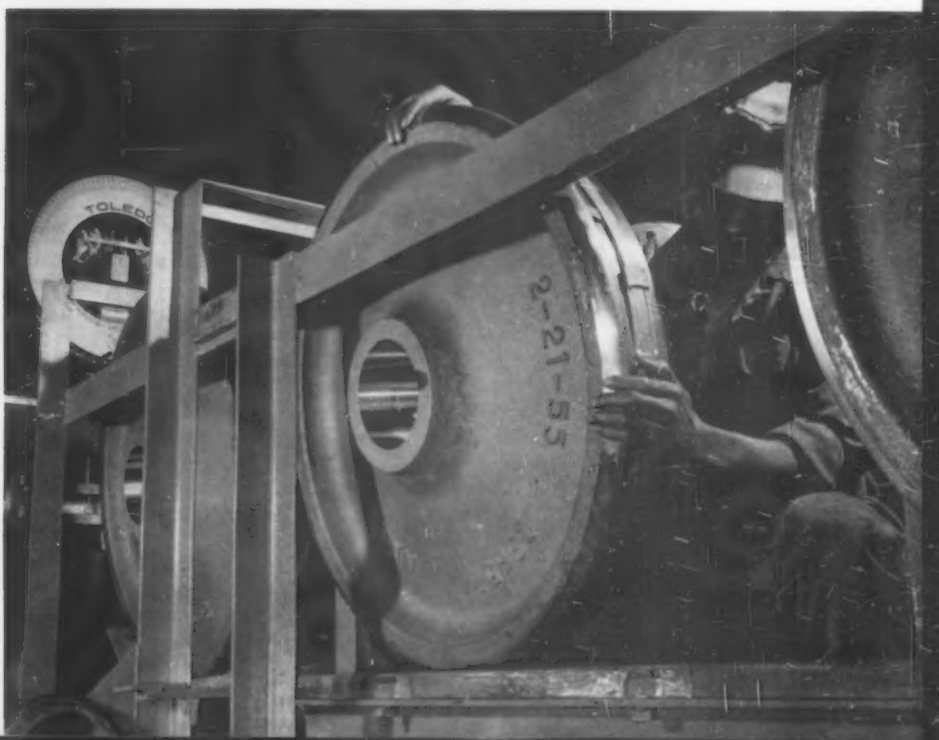
Machining. A battery of four automatic vertical turret lathes machine the wheels. The flange contour and primary taper on the tread are generated by means of a contouring attachment which operates by following a template. This insures that all treads will have the same correct contour. Machining the secondary taper on the tread, facing the rim, and boring and facing the hub is also performed automatically. By machining these surfaces, the dimensions specified by the railroads can be easily maintained. The complete job is done on one machine, with one chucking which results in little lost time for handling and maintains concentricity between tread and bore.

Inspection. After the wheel is machined, it is placed on another gravity conveyor which moves it to the weigh, tape and stenciling station. Here the wheel is tipped into a vertical position so that the circumference of the wheel can be gaged. The wheel is then stenciled and rolled across a scale and out to the wheel platform. A lift truck removes the wheel from the conveyor and places it with other wheels from that day's cast to await inspection.

After visual inspection, clearance of the final chemical analysis and mechanical properties by the metallurgist and inspector, another new 1.5 carbon cast steel wheel is ready for shipment.

Machining of wheels is done on a single machine with one chucking, reducing handling and maintaining concentricity of tread and bore.

Gravity conveyor takes the wheel to the weigh, tape and stencil station. Laboratory clearance is the final step in this cast steel operation.



CUPOLAS DESIGNED for SLAG CONTROL

Improved cupolas designed by Belgian experimenters use water cooling to stabilize refractory and control slag contamination

This article is a condensation of a report entitled "Metallurgical Studies of the M.B.C. and ADS Cupolas" by Prof. A. De Sy, Robert Doat, Roger Balon and Lucien Winandy, all of Belgium. It was presented at the International Foundry Congress in London, June, 1955, as the Official Exchange Paper from l'Association Technique de Fonderie de Belgigue. The complete paper was published in the Foundry Trade Journal, December 1, 1955.

Both the cupolas described in this Belgium exchange paper were designed with the common chief objective of stabilizing the refractory in the melting zone by means of water cooling. This practice eliminates all subsequent contamination of the slag during melting so that the estimated composition of the slag charged will approximate very closely that of the slag actually formed. Thus the slag by its composition and volume can be a key to the control of the properties of the iron.

As a consequence it is possible to control and maintain the iron composition within the desired analytical limits. Obviously, the other factors to be associated with running a cupola are taken into consideration: the nature of the blast, its temperature, the coke to metal ratio, etc. Several outstanding economic advantages are derived from this innovation, namely the use of cheaper raw materials and a reduction in the consumption of refractory and the cost of patching which often run into considerable costs in labor, materials and down time.

The operation of the M.B.C. (metallurgical blast cupola), Fig 1, and the ADS (a development of Prof. A. De Sy), Fig 2, have the common characteristic of controlling the cupola melt through close control of the slag composition. This can be accomplished only in the absence of the contaminating influence of any erosion or absorption of the cupola refractories.

In the case of the M.B.C., erosion is suppressed by exterior cooling and contact with the lining is minimized by a special system of continuous casting. The M.B.C. operates with a reducing atmosphere obtained by preheating the blast and by proper layout of the tuyeres. It is lined with mullite bricks to a point 20 in. (500 mm) above the tuyeres and from here to the bottom the lining is a rammed silicious material containing graphite. The close slag control possible in this cupola results in precise control over the elements C, Si, Mn, S & P in the metal so that any desired composition can be attained.

The ADS cupola is basic lined with magnesite and water cooled on the casing. Its main characteristic is the narrowing of the shell in the melting zone and in the tuyere zone. The construction of this cupola is relatively cheap and should be considered complementary to the M.B.C. from the standpoint of use. It is a melting device capable of controlling between certain limits the composition of the iron through adjustment of the slag and general operation. The control is limited, however, to the C and S. Aside from the C and S control in the ADS, the concentration of the other three elements is determined by the metal charge and the metallic losses associated with the thermal and chemical conditions of the operation.

There is an essential difference between the ADS and the more common basic cupola. In the latter the erosion of the basic lining in the melting zone is an important factor influencing the composition and mass of the slag. As the erosion varies during the melting period, and as this melting is a function of thermal and chemical changes, close control of the composition of the slag leaves much to be desired.

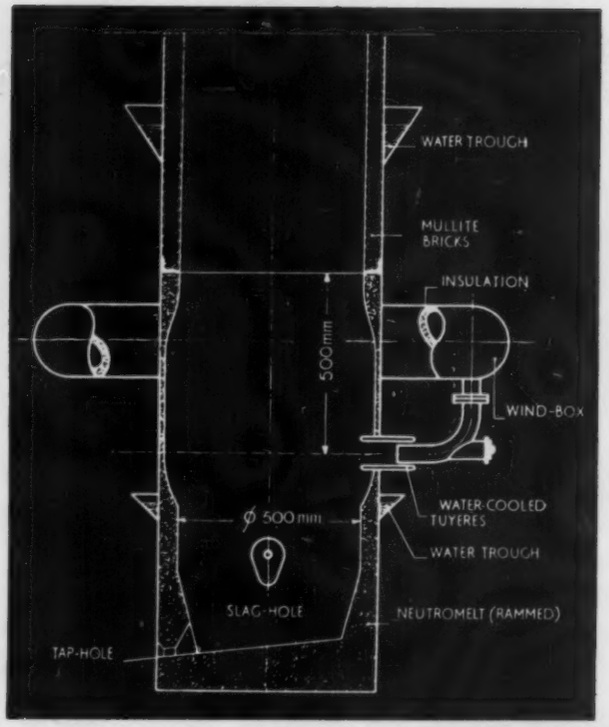


Fig 1. MBC cupola permits close control of C, Si, Mn, S, and P.

In contrast, the ADS cupola casing soon has none of the magnesite lining left in the melting zone except for a thin layer of surface-fused lining and in the hottest part a layer of strongly oxidized and magnetic basic slag. With this relatively inert lining established, the slag, both in composition and mass, can be adjusted with distinct precision.

Additional advantage comes from eliminating any need for repair to the lining in the melting zone, thus permitting the cupola to melt continuously or intermittently every day instead of every other day.

These two novel cupolas have further enhanced the many advantages inherent in cupola melting that make its production capacity higher and its operating costs lower than any other melting apparatus for cast iron.

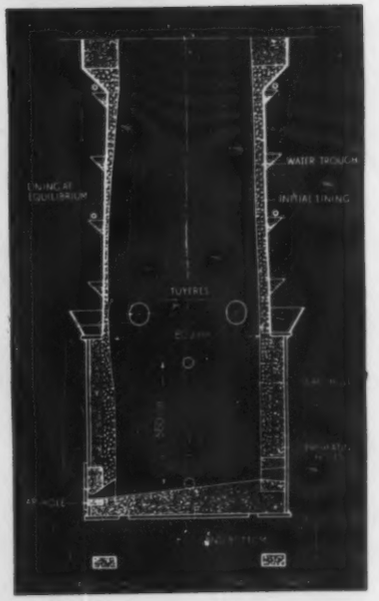


Fig 2. Close control of C and S is possible with ADS cupola.

YOU CAN QUENCH-AGE MALLEABLE IRON:

Hardness and tensile strength may be introduced by subcritical heat treating

C. A. BEISER / *Research Asst.*

E. B. EVANS / *Research Associate*
Case Institute of Technology

Quench-aging is a combined solid solution and aging phenomenon which increases the hardness and tensile strength of low-carbon steel when cooled from below the lower critical temperature, A_1 = 1330 F. Since ferritic malleable iron is a two-phase structure consisting of graphite rosettes in a low-carbon matrix (ferrite), it should also be susceptible to quench-aging.

To test this prediction, a short study was made of the hardness properties of a ferritic malleable iron after various quench-aging treatments. Specimens about 3/8-in. thick were heated at 1300 F for ten minutes in a salt bath and quenched into water or air cooled. Quenched specimens were aged at 80, 125, 350, 600 and 850 F for various times. Hardness as a function of aging time is shown in Fig 1.

The hardness of the air cooled specimen did not change with time at room temperature, indicating that quench-aging effects were absent when employing a slow cooling rate. However, the marked changes in hardness after water quenching and aging and the shape of the aging curves are characteristic of quench-aging systems—maximum hardness and the time to reach a maximum decrease with increasing aging temperature. The as-quenched hardness was ten points above that of the air-cooled hardness. This corresponds to the solution effect or the supersaturation of the ferrite with carbon and/or nitrogen. By room temperature aging, the hardness was raised four points above that of the as-quenched value. This corresponds to the aging effect or the rejection of carbon and/or nitrogen from supersaturated solution as carbides or nitrides too finely dispersed to be resolved under the microscope. The maximum cumulative hardness due to the combined solution and room temperature aging effect amounts to 14 points Rockwell B.

A number of microstructures were examined but no differences in structure before and after heat treatment were detected.

With lower solution temperatures and with cooling rates intermediate to an air cool and water quench, it is to be expected that the quench-aging effects would be minimized due to less carbon and/or nitrogen retained in solution on cooling and, consequently, lesser amounts available for the precipitation or aging reaction.

The so-called galvanizing embrittlement may be due in some measure to the quench-aging mechanism. Excerpts from Bean's paper certainly point to this phenomenon:

". . . deterioration was more severe when castings were quenched in cold water immediately after removing from the zinc than if warmer water were used or if time elapsed between removal and quenching."

". . . the so-called galvanizing brittleness can be induced in the higher phosphorus specimens without any contact with zinc whatsoever."

". . . galvanizing embrittlement may be avoided—by the use of high temperature quenching baths (300-600 F), or by eliminating quenching entirely."

Hydrogen embrittlement may also be a factor in galvanizing embrittlement. It is now under study.

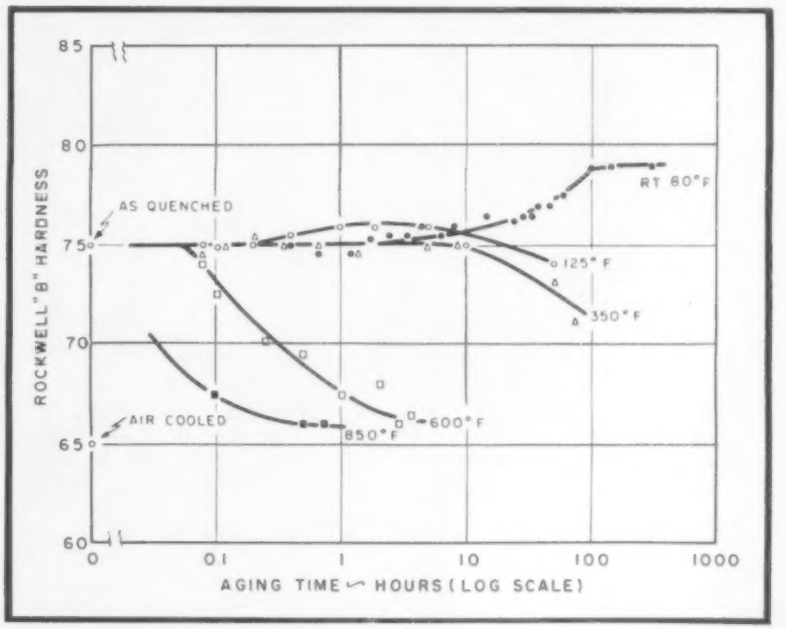
To check the possibility that malleable iron could be hardened from the galvanizing temperature, a specimen was water quenched from 1300 F, reheated to 875 F and water quenched. The as-quenched hardness was Rb 72, but did not change with time at room temperature. Although aging effects would appear to be absent with this treatment, the as-quenched hardness was seven points above that of the air cooled hardness, indicating a significant solution effect.

The results support the view that subcritical heat treatment of malleable iron can introduce quench-aging effects, and that the mechanical properties must be defined in terms of such factors as subcritical solution temperature, cooling rate, aging time and temperature.

Bibliography

1. W. R. Bean, "Deterioration of Malleable in Hot-Dip Galvanizing Process," *Trans. AIME*, v 69, 1923, p. 895-922.

2. G. E. Kempka, "Embrittlement, Toughening and Subcritical Thermal Treatment of Malleable Iron," *Trans. AFS*, v 63, 1955, p. 675-682.



Hardness as a function of aging time is shown following quenching.

ROLL OUT THE CASTING MACHINE

New die castings plant switches machines and highballs casting production in railroad style

Doehler-Jarvis division of National Lead Co. is now operating a new die casting plant where production of a single casting moves from metal ingot to die cast pieces packed in cases and ready for shipment all in the same day. The two story, 210,000 sq ft building is located in Stowe Township, outside Pottstown, Pennsylvania.

The most unique feature of this new plant is the physical set-up of the casting machines. Each machine is anchored at its working location on "trolley" tracks. When an order for die castings is completed and the respective casting die must be dismounted from the casting machine, all lines supplying electric power, hydraulic pressure and water are quickly disconnected, a track-guided building on wheels which runs the entire length of the structure comes alongside and lines up its own tracks with those of the die casting machine. This machine is power-pulled into the trolley building and sped to the "service area." Meanwhile, another machine, already preheated and with another die for a different casting, is taken to replace the machine which has been withdrawn. The machine which has been withdrawn is then serviced and another die is mounted in place and made ready for the next interchange of machines.

The time normally required to dismount one die and to mount another might be anywhere from a few hours' time to 15 to 20 hours. The unique method of withdrawing the casting machine from its place and replacing it with another machine and casting die reduces the lapse of time of non-productive hours to 20 or 30 minutes.

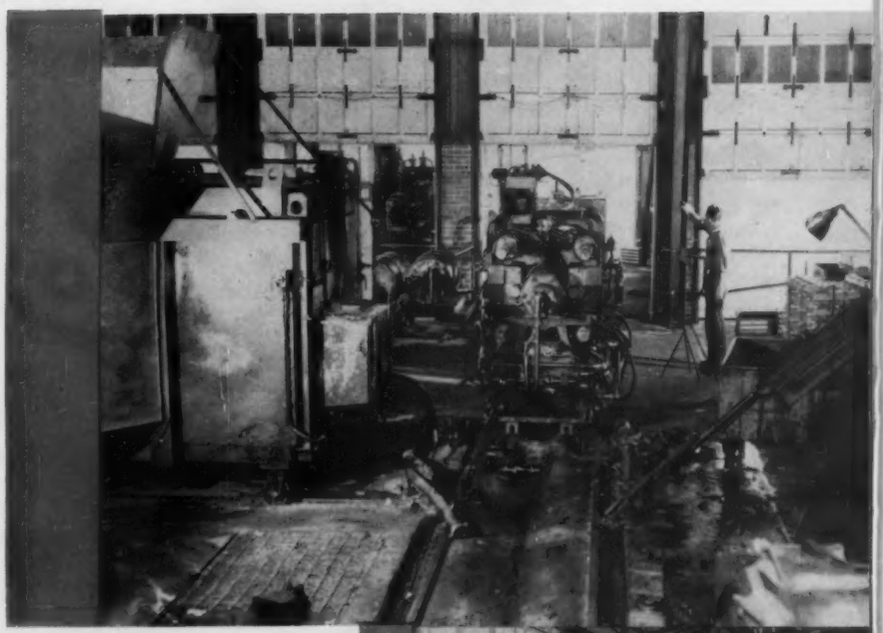
The hydraulic system used in this plant is the most modern in the die casting industry. To force the molten metal into the steel dies, hydraulic pressure of 1,275 pounds per square inch is used. The pressure is created by centrifugal hydraulic pumps and distributed in 10-inch pipes. A central hydraulic area has been installed.

The plant, which produces aluminum die castings, is designed to take advantage of all space, and its operations are conducted on a "straight line" basis. All casting machines are on a direct straight line, and trimming operations take place on a straight line behind the casting machines. After this the castings are machined, inspected, packed and lowered to the loading platform.

Die castings from this plant serve many industries, including parts for household appliances, office equipment, the communications industry and the electronics field.

The entire casting, trimming, machining and inspection operations in this plant are conducted on the second floor. This system permits use of the outside "trolley" in machine exchanges, and enhances the ventilation system. The first floor of the plant consists of office spaces, a cafeteria, locker and shower rooms, the hydraulic and power areas, and a space for displaying the end products of customers using die castings. As Frank J. Koegler, vice-president and a director of National Lead Company and general manager of the Doehler-Jarvis Division said: "This plant represents a $5,000,000 experiment in human engineering as well as product engineering—and it works fine."

Engineering of this plant is another development by a company that has been developing large aluminum and magnesium die castings as competitors of gray iron castings. Doehler-Jarvis announced the experimental production of a die cast aluminum six cylinder auto engine block this spring and A. F. Bauer, chief engineer of the firm, has described the progress of experiments with a die cast aluminum V-8 block.



Die casting machine rolls from trolley building onto tracks where lines will be connected.

Production line photo shows machines anchored on tracks that bring them into work area.

Preheated machine with new die moves into trolley building for the trip to production line.

CORE BLOWING

- HISTORY
- EQUIPMENT
- COMPONENTS
- PRINCIPLES

A MODERN CASTINGS

— BONUS —

This special report is the 16th in a consecutive monthly series prepared by the editors of MODERN CASTINGS to provide detailed analyses of important current problems facing the castings industry. These bonus sections comprise manuals of practical information which have proven extremely valuable to foundry management, operating and technical departments. A limited number of reprints are available for 50 cents each.

HISTORY

A. M. CLARK
Ford Motor Company

Coremaking is an ancient art that has become standardized only in the past century

Coremaking methods and equipment are one of the fastest-changing aspects of the metal castings industry. This careful summary of the present day scene in core blowing was presented at the sand division dinner of the American Foundrymen's Society 60th Casting Congress and Exhibit at Atlantic City last May. The author is manager, manufacturing engineering-foundries, of the Ford Motor Company. He brings years of coremaking experience to his subject.

Too often we stress the needs of the high production foundries without giving enough thought to the smaller shops. In this article we hope to cover core blowing for both the small and the large foundry – along with discussing new developments, both in the Ford foundries and the rest of the industry, in which a wide variety of techniques are used for blowing cores.

As a start, let's take a look at some early history, and a few types of core blowing machines.

The casting of cats in bronze (Fig 1) was accomplished during the 7th century B. C. When this casting was broken open a permanent asphalt core was revealed. Apparently foundrymen had shake-problems in the early days, too.

Fig 2 is a view of the oldest known cast iron stove, made around 206 B. C. Thus, we see that the earliest castings were made by using cores. I doubt if the tolerance of this core was held to plus or minus 0.010 inches.

Fig 2. Oldest known iron stove required use of cores.

The sketch in Fig 3 shows the crude method used to form an early bell core. The casting of bells exerted quite an influence on the foundry industry. The demand for church bells of various sizes raised the casting of metal to a practical art – and so it was the church that gave the foundry an incentive that encouraged early developments.

It is interesting to note that the "lost wax process", which is investment or destructible pattern molding, was used by the early Egyptians. This principle has retained its importance for more than 3500 years. In fact, this process, as used today, has contributed to the superior performance of our jet aircraft.

It wasn't until the 19th Century that core making became standard

Fig 1. Asphalt core revealed in ancient bronze casting.

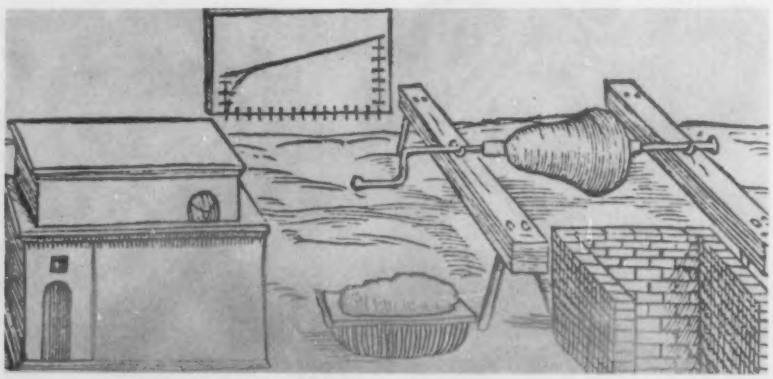


Fig 3. This crude equipment was used to form cores in church bells.

ized and equipment was made available for mass production in American shops. Fig 4 depicts a common core room scene around 1880. The cores were dried in kilns and then placed on racks to be carried to the foundry.

Core blowing machines were introduced into the core room about 45 years ago. Fig 5 pictures an American blower developed around the turn of the century. There is a story told about the introduction of one of these machines. On this particular day a new device called the core blower was set up in the core room of a Detroit foundry. Murphy, a big Irishman in charge of the department, was going to try out the machine.

Naturally considerable interest was aroused in this new fangled device and a crowd gathered around. The core box was placed in position and Murphy pulled the blow valve. As luck would have it, the box wasn't clamped, and a famous saying was born, "The wind blew and the sand flew and there stood Murphy". However, Murphy was stubborn and loaded the machine for another try. This time the core was blown and the machine was reluctantly accepted as a practical method of making cores.

Early progress was slow and kept highly secretive. A core maker was a craftsman and to protect his trade he would not reveal any new developments or operating techniques. One example of this was brought out when a core maker went on vacation. His job had been running successfully before he left but now the new man could not blow a good core. When the box was taken apart it was found the regular core maker had deliberately plugged the vents in the box before he left in an effort to safeguard his job.

Core making practice in this country has improved rapidly in recent years in response to the demands on the foundry for quality, lighter casting weights, and closer casting dimensions. The material suppliers, manufacturers, technicians, and foundrymen alike have contributed to this progress.

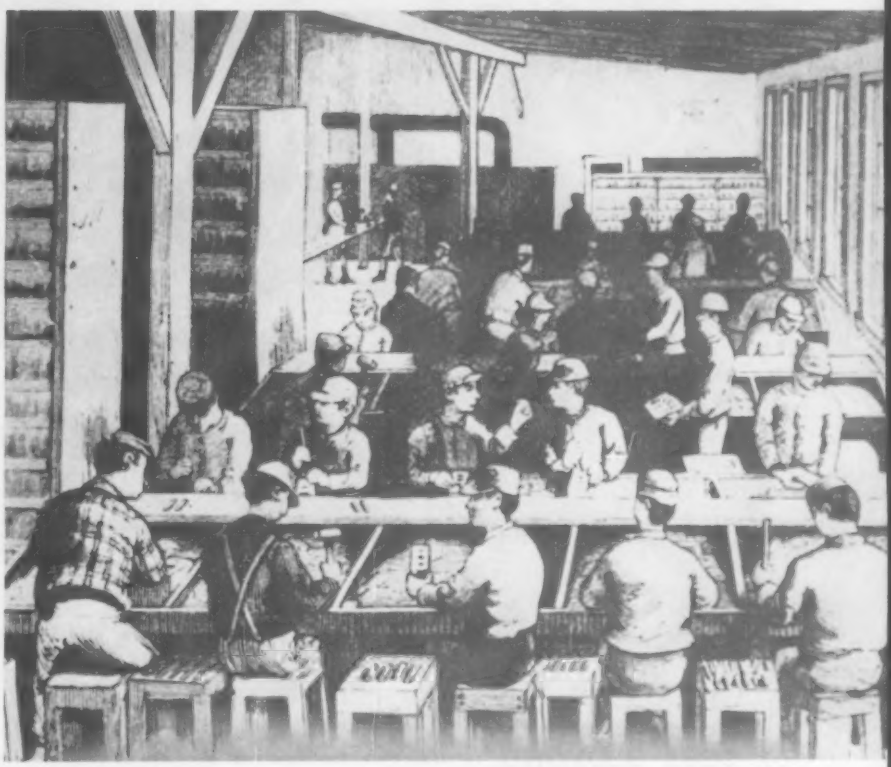
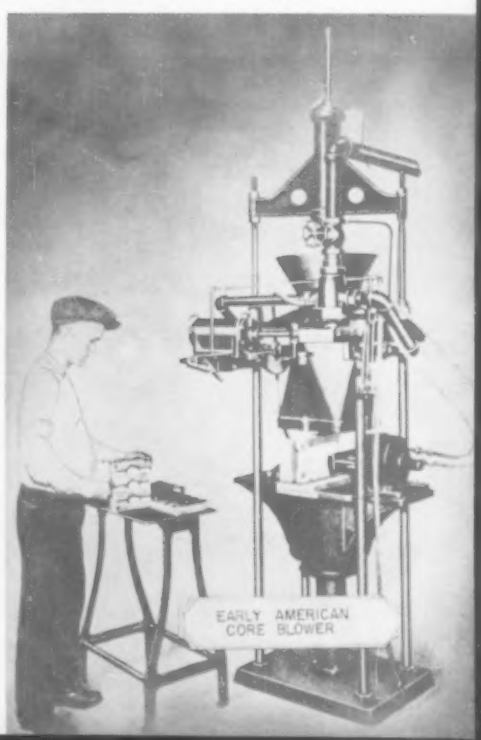


Fig 4. This view shows a typical core room in a shop about 1880.

However, there is still a great need for improvement. Metallurgical advancements have made it imperative that we further reduce the dimensional tolerances of cores. Modern casting designs demand more intricate and improved coring, to reduce the end cost for today's competitive market.

An example of the savings that can be realized by using cores is the number of gun and tank parts cast during World War II for the United States Army ordnance department. Prior to the war many of these particular parts were machined from solid blocks of steel. By changing the metal specifications and using cores, these parts were cast at about half the previous weight and the machining time was reduced by more than 50 per cent. This is not an extraordinary example. The foundry industry is constantly striving to accomplish similar improvements.

Fig 5. Early core blower.



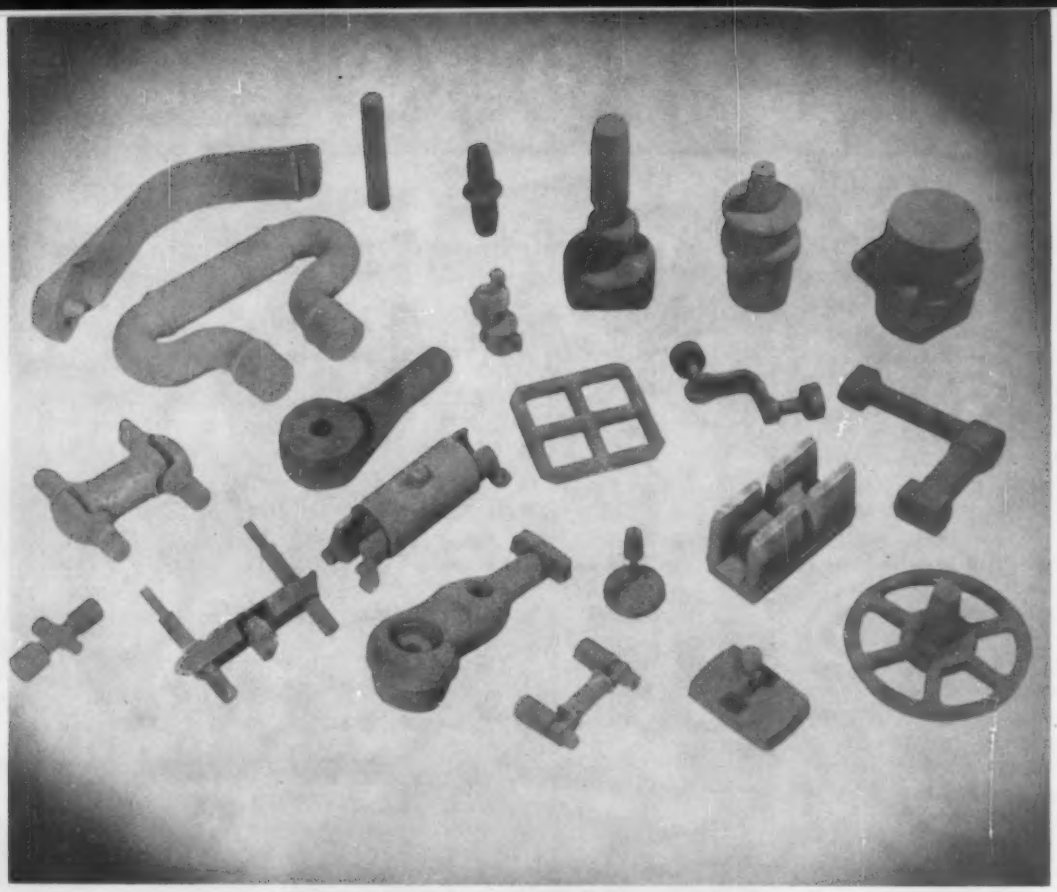


Fig 6. Bench blowers produce a variety of intricate cores.

CORE BLOWING

EQUIPMENT

Core blowing machines are versatile. Choice depends on the job

Fig 7. Cartridge type blower.

For the purpose of discussing core blowers we have arbitrarily classified the machines into two basic groups, small bench blowers and large floor models. Small machines may be classed as bench blowers even though they may be mounted on bases and could be considered floor models.

Core rooms having low production jobs will find small machines more efficient and economical. Because of high initial investment it is not practical to have a costly, large machine idle during numerous job changes.

Fig 6 shows a few examples of cores blown by a small bench blower today. It is reported that the bench blower was introduced in the early 1940's. Because of the simplicity of design, core box rigging and high comparative productivity, bench blowers were readily accepted by many of the more progressive foundries with production schedules that warranted their use.

Fig 7 illustrates a cartridge type bench blower. The cartridge, which is commonly referred to as a sand magazine, is considered a part of the core box equipment. However, one cartridge may be used for several boxes of approximately the same size. The tubular part of the cartridge must be high enough to hold sufficient sand to fill the core box. The cartridge is filled by hand.

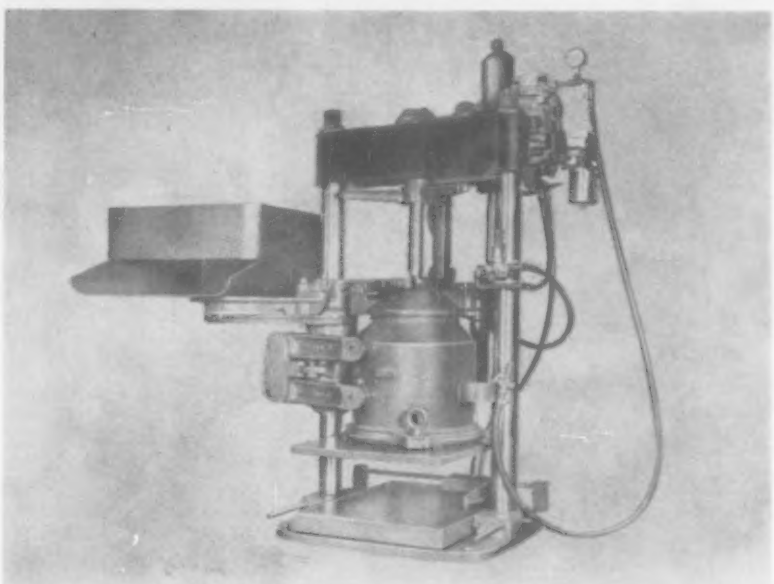


Fig 8. Sand magazine swings from blowing to filling point.

Then the core box and cartridge are placed in the machine for blowing. The right handle clamps the box. The left handle blows the core.

A swing type bench blower is shown in Fig 8. The sand magazine swings from the blowing to filling position, either mechanically or manually, according to the manufacturer's design. On some models, the sand magazine swings in the direction of the operator; others swing to the rear.

In Fig 9 is seen a bench blower which has a stationary sand magazine. This eliminates the time and effort of moving the magazine from the filling to the blowing position. The table is adjustable for different height core boxes. Actuating one handle puts the machine through a complete blowing cycle.

Now let's take a look at large floor model blowers, which have the advantage of lending themselves more readily to automation.

An average size machine is pictured in Fig 10, with a stationary sand magazine, automatic controls and sand feeder. The advantage of this type machine is that the sand magazine does not reciprocate. When the top half of the box is mounted on the blow plate, the line up of the upper and lower halves of the core box can be kept very accurate, thus assuring successful drawing of intricate cores.

Some modern machines can be run continuously when they are equipped with individual stations for blowing, rollover and draw mechanisms. It is necessary to stop the machine only to change boxes.

Fig 9. Sand magazine is stationary on bench blower.

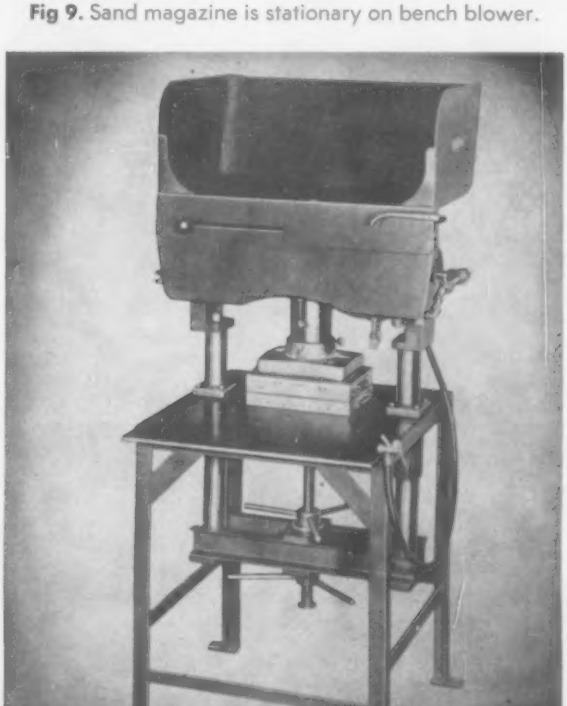
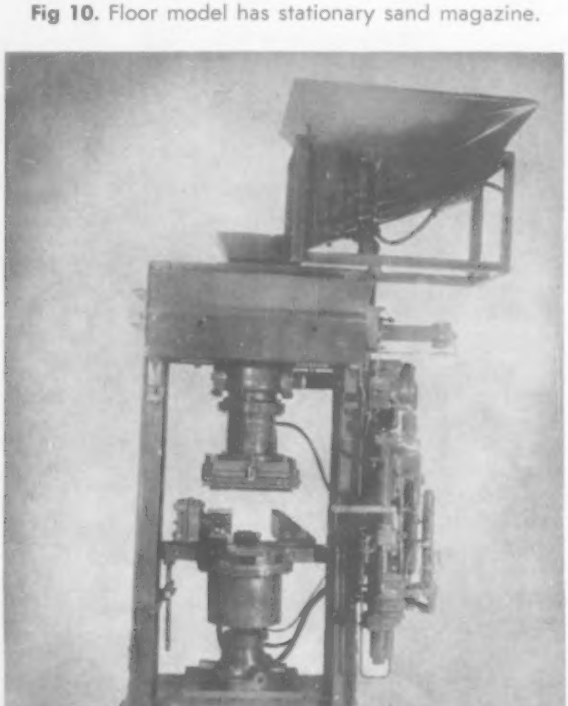


Fig 10. Floor model has stationary sand magazine.



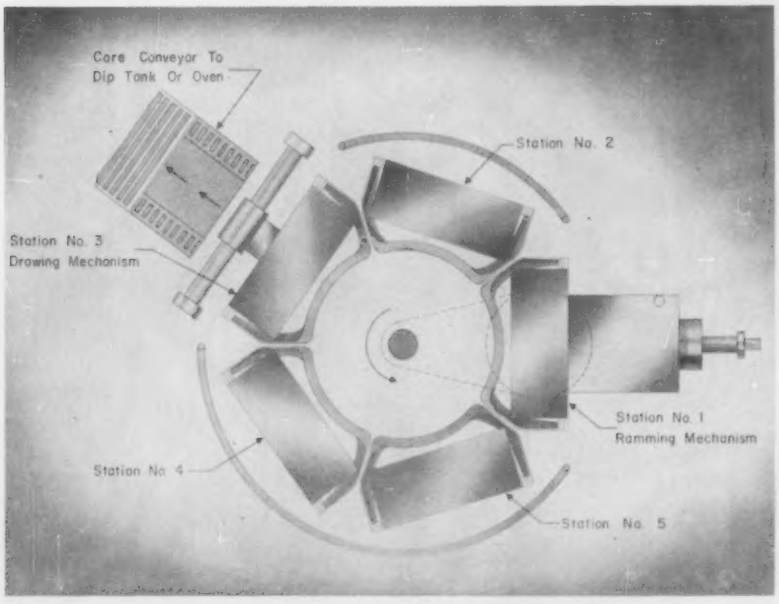


Fig 11. This machine has 5 stations.

applied and core support wires placed if needed.

The machine shown in Fig 12 is believed to be the world's largest core blower. The sand magazine holds approximately 3000 lb of sand. There are two diaphragm-type blow valves, each having a 4 in. diameter opening and the air-line feeding the machine is 6 in. in diameter. The hydraulic clamping pressure is close to 75 tons. Two of these machines were used to blow cores at the magnesium foundry of the Ford aircraft plant in Chicago. The blower is designed for cores up to a maximum weight of 1500 lb. In the Ford plant, however, the largest core blown weighed 375 lb.

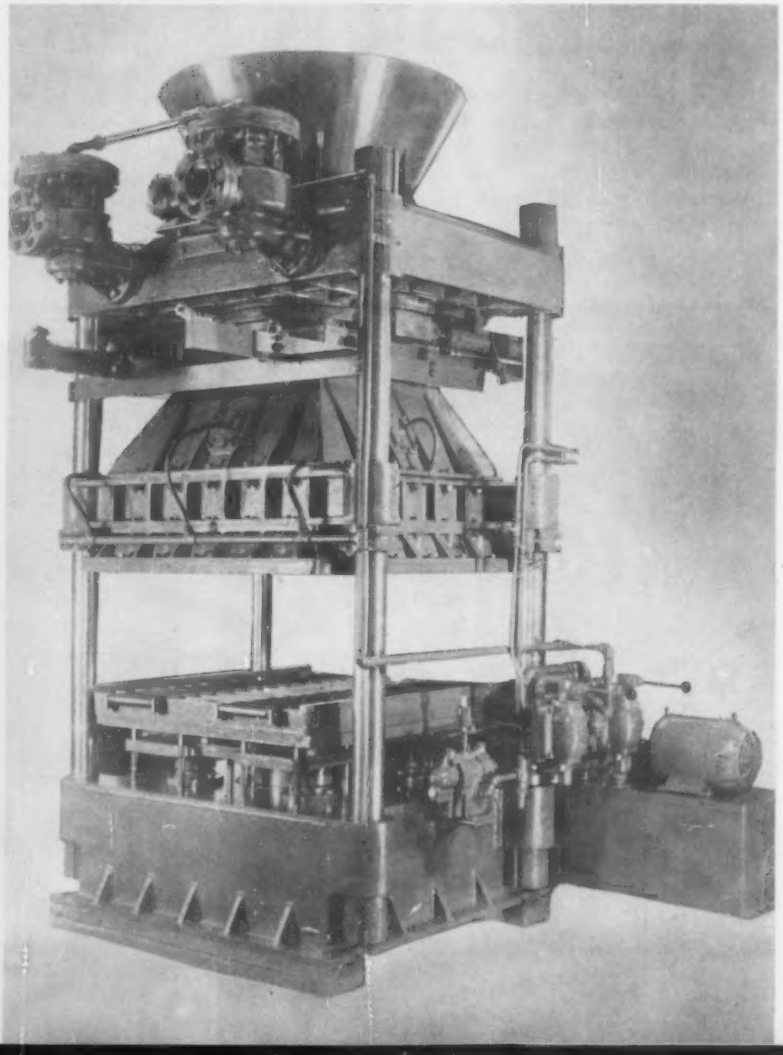


Fig 12. World's largest core blower.

Fig 11 illustrates an example of a high production operation. If all stations on the machine are rigged for the same core, only one upper core box half is needed. This is mounted on the blow plate while the lower halves are mounted on each of the stations. If the machine is rigged for similar cores, then both upper and lower core boxes are placed at each individual station.

After each phase of the operation, the table advances one position. At station one, the core is automatically blown and the box unclamped as vibrators operate against it to free the core. The lower half of the box and core are lowered onto the indexing table. Next, the table moves up to station two where a dryer is placed on the core. When the table indexes to station three, the dryer is clamped to the box, both are rotated 180 deg and then vibrated as the core is drawn from the box and left resting on the dryer. The box is then rotated back to its original position.

Stations four and five are considered make ready stations, where loose sand is automatically blown from the box, a parting agent is

COMPONENTS

Important components help solve typical blowing problems of abrasiveness, channeling, lumping

Having covered several types and sizes of machines as a complete unit, let's discuss some of the important components of the core blower and the role they play in blowing cores.

The basic principle of core blowing consists of floating sand into the core box by using the medium of compressed air. In our present day machines the velocity of the air must be kept high to obtain the desired velocity of the sand particles, thus insuring their deposit in the remote corners of the core box. It follows, therefore, that the air pressure within the box must be relieved by adequate venting. Fig 13 shows the pressure drop from 100 psi at the inlet to 95 psi at the top of the sand magazine and 90 psi at the bottom. The air pressure in the core box shows a well vented condition.

Most core blowing machines are served by an airline carrying 95 to 125 psi of air at the machine. Some cores can be blown at 80 psi pressure but as a general practice it is recommended that a pressure of 90 psi be used.

A sufficiently large air inlet to the machine should be provided so that when more and larger blow holes are used, the pressure drop from the blow valve to the core box is held to a minimum. A 2½-in. air inlet is recommended for the smaller size blower and a 4-in. inlet on the larger size.

Air must be introduced as quickly as possible to minimize the

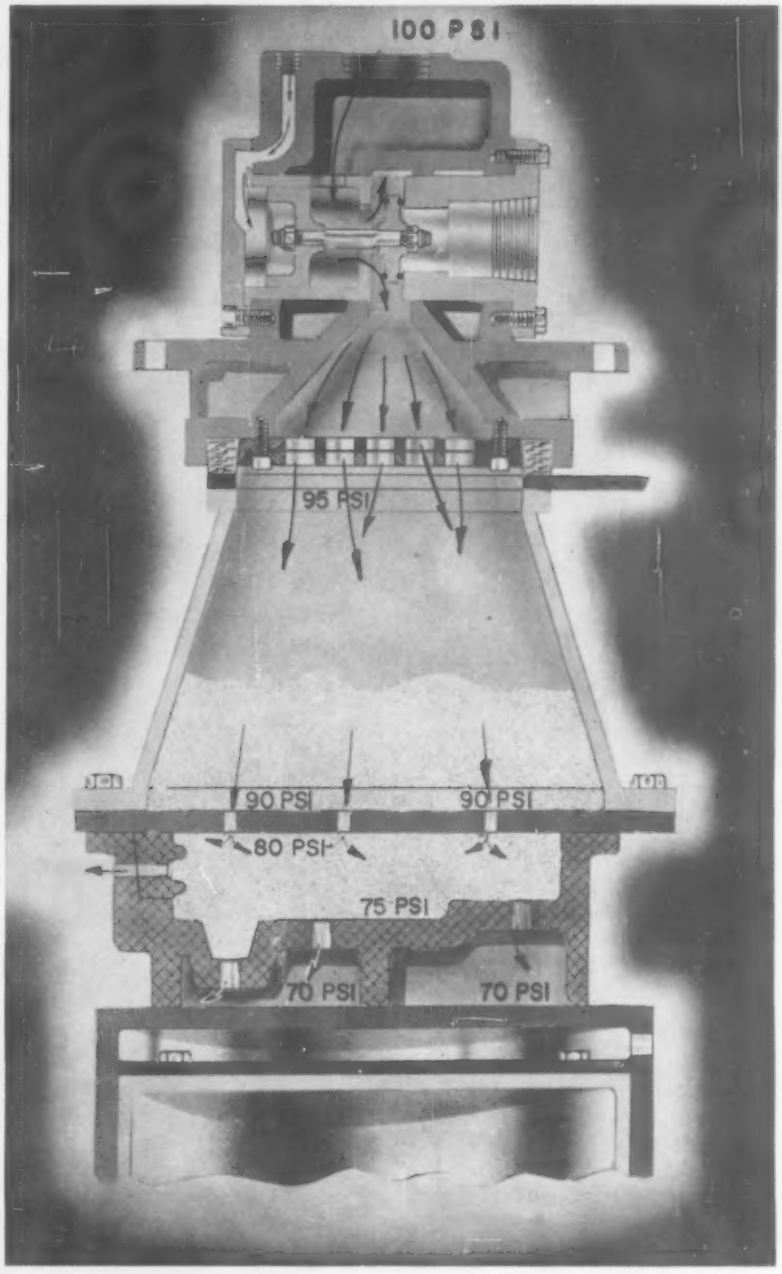


Fig 13. Satisfactory air pressure drop shown in diagram of blower.

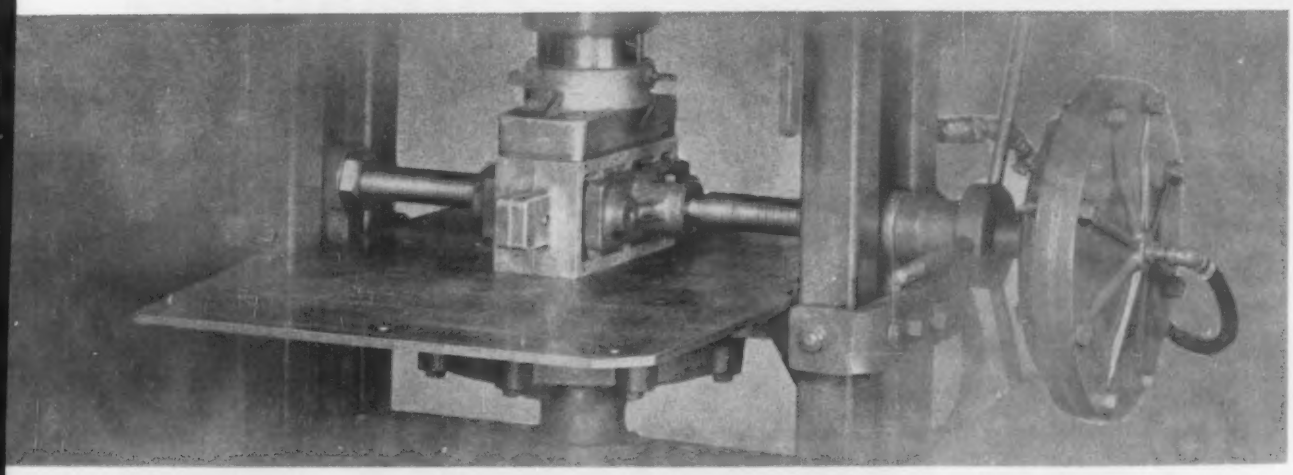
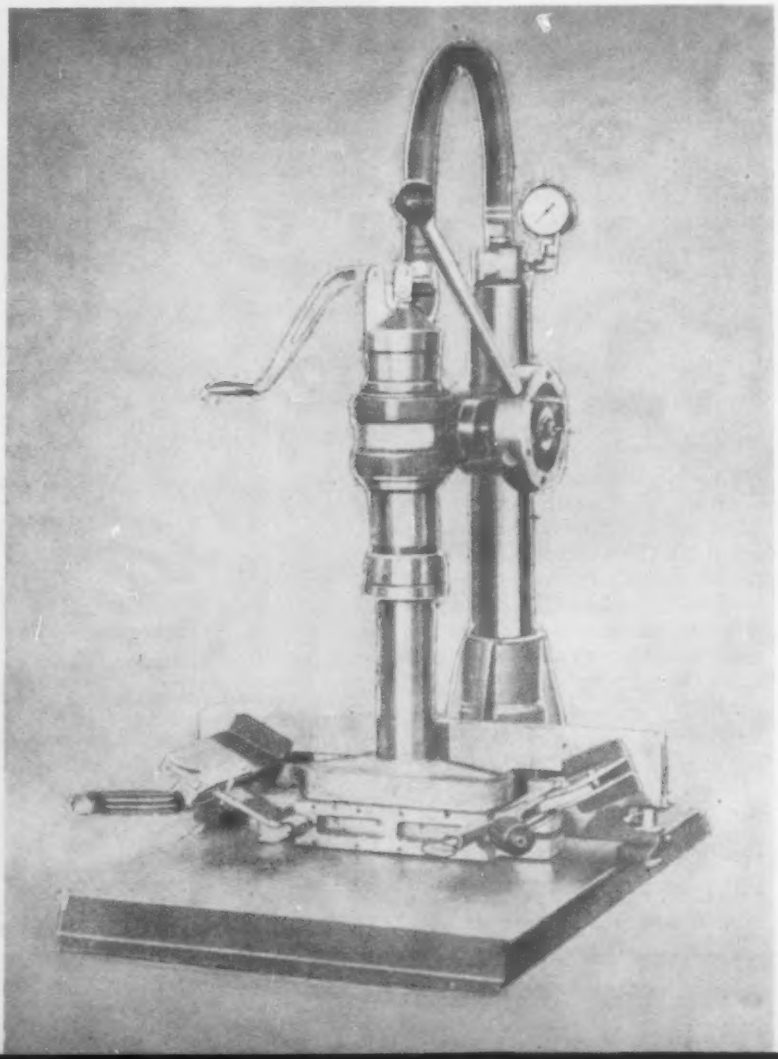


Fig 14. This automatic clamping device also positions the core box and lines up the blow holes.

Fig 15. Manually operated clamps are used for low production jobs.



effects of channeling. This requires a fast acting inlet valve and an air receiver for the machine. If there are several machines on a common airline the engineer must be careful to use an air header of sufficient size to prevent line pressure drops.

Air is usually introduced into the machine by a poppet valve, slide type valve, or diaphragm.

To resist the high pressure of air required to blow a core, we find it necessary to hold the box in the machine by either an automatic or a manual clamp, Fig 14. This particular clamp is used for automatically positioning the core box horizontally. It keeps vertically split core boxes closed during the blowing sequence and lines up the blow holes between the blow plate and the core box.

The manually operated clamps shown in Fig 15 are used for low production jobs only. Another common clamping technique uses table-mounted guides which position the box so the blow holes are lined up properly. Guides of this type can be utilized when the boxes of relatively the same size and shape are continually run on the same machine.

The mechanical clamp in Fig 16 raises the core box in a vertical squeeze, thus forming a seal between the blow head of the ma-

chine and the magazine, also between the blow plate and the core box itself. It is important that the clamping pressure be greater than the blowing pressure in order to avoid blowing out at the parting.

The next component that serves a very necessary purpose is the sand magazine, Fig 17, the sketch shown here represents a plain sand chamber which manufacturers can supply in various sizes and shapes to accommodate a variety of applications. In our opinion, a magazine should be selected which has a bottom opening equal to or slightly larger than the core box to be filled. We highly recommend that the manufacturers' specifications be adhered to in determining the magazine size and shape. When trouble arises in blowing a new job the magazine capacity is frequently overlooked as a source of the trouble.

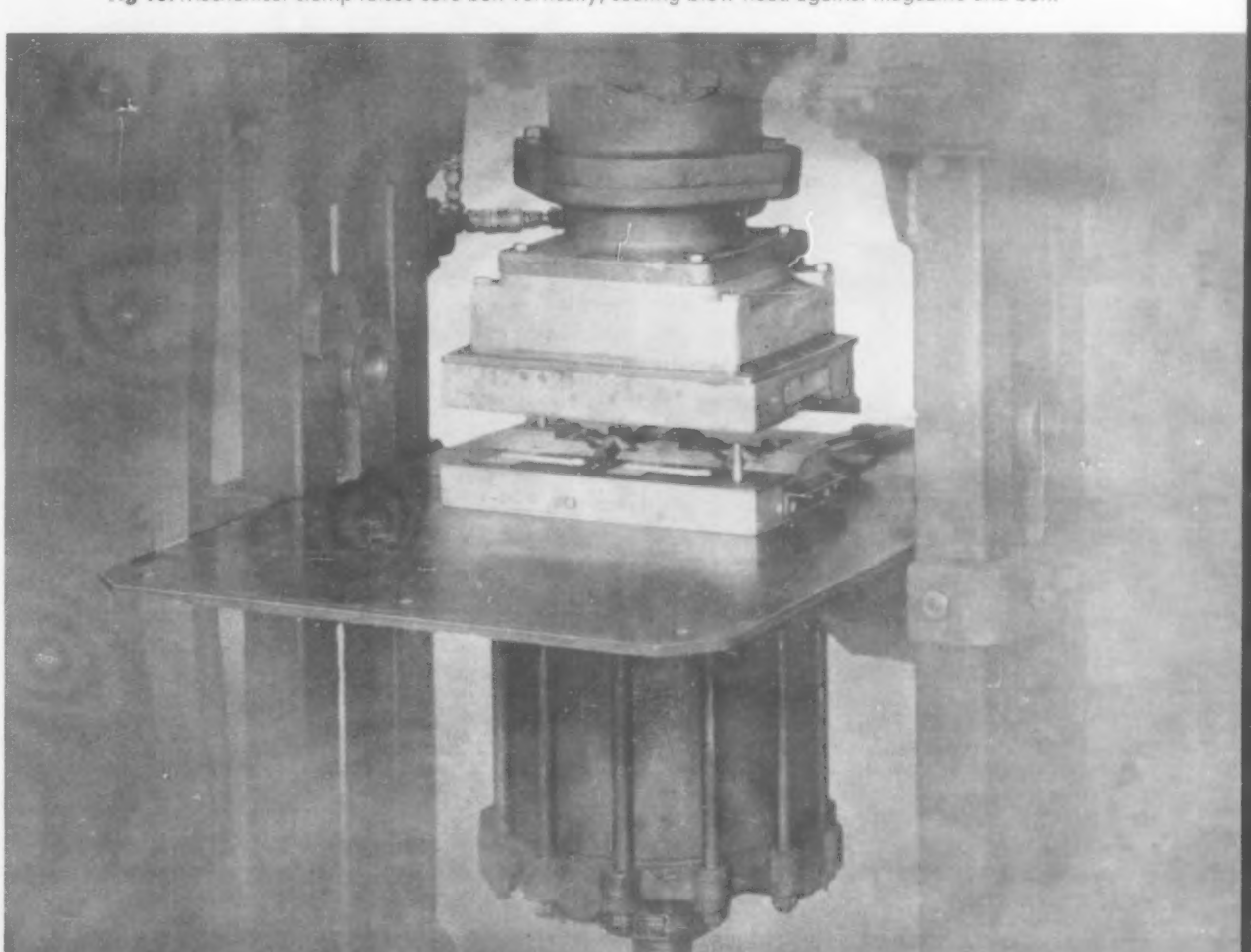
Under certain conditions sand adheres to the inside walls of a magazine. When this happens it is necessary to rap on the chamber to move the sand. Plating or an application of plastic has been used with some success to eliminate this problem.

One of the major difficulties in core blowing has been the channeling of sand in the magazine. Fig 18 shows what is meant by channeling. It is our opinion that tunnels start to form above the blow holes while blowing the core. The air entering the top of the magazine passes through the sand and as the air approaches the small blow holes its velocity is increased sufficiently to tear sand loose from the mass and carry it into the box. The cavity left in the sand magazine becomes progressively larger until it fails to support the sand above, causing it to drop and lower the sand in the chamber. Then the channeling starts over again. This condition prevents blowing good cores and causes excess core box wear.

Agitation within the sand magazine may be necessary to prevent channeling in some applications. The agitation may be performed by having the air enter the magazine through a slotted or screened inner liner, shown in Fig 19. This method creates an aerating air circuit that conditions and carries the sand through the blow holes into the core box.

Continuous agitation can be pro-

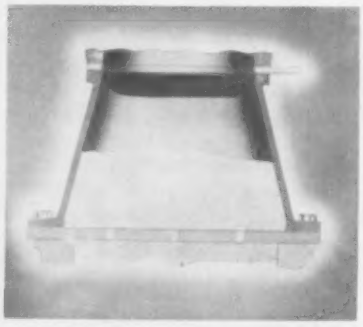
Fig 16. Mechanical clamp raises core box vertically, sealing blow head against magazine and box.



duced by rotary type mechanical paddles, Fig 20. This keeps the blow plate evenly covered with sand at all times during the blowing operation.

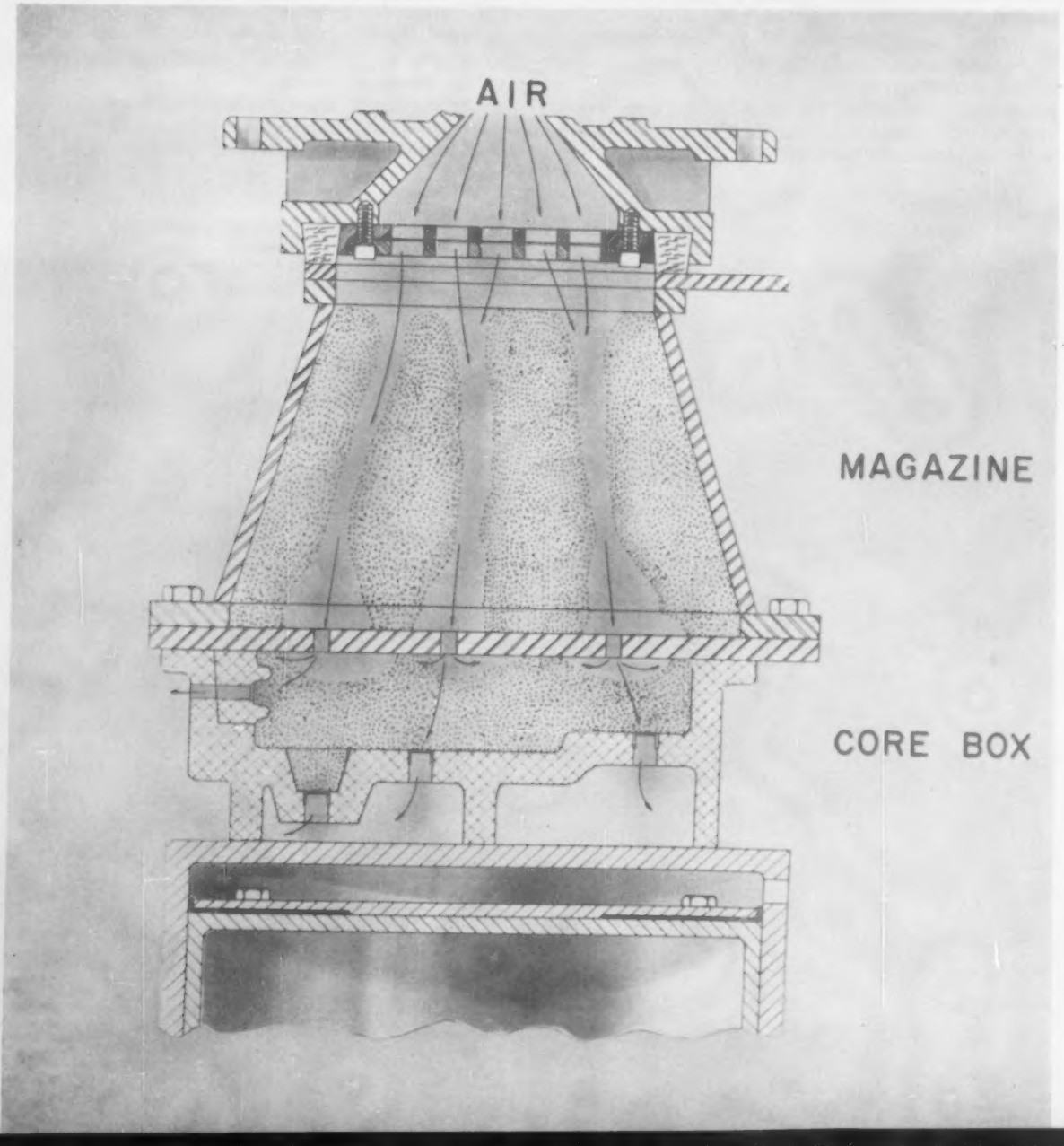
The blow plate (Fig 21) is also important in this review of machine components. The purpose of the single blow plate is to seal the bottom of the sand magazine and direct the sand into the core box through the blow holes in the plate.

Fig 17. Typical magazine for sand.



The double blow plate, shown in the lower view of this slide, serves the same purpose as the single plate and provides additional venting, thereby reducing the number of core box vents to a minimum. Note the flow of the air passing out through the vents in the lower

Fig 18. Diagram shows how air channels through sand above blow holes preventing good coreblowing.



plate, on out between the double plates held apart by spacers. Almost any foundry can make its own vented blow plates so that the greatest amount of venting takes place in the plate and not in the body of the core box. On high production machines it is common to have the top of the core box mounted to the blow plate.

The universal blow plate (Fig 22) is widely used in small foundries and job shops. A universal blow plate can take the place of a large number of regular blow plates. The blow tubes and vents are interchangeable. Thus, by merely moving the blow tubes to the positions needed the universal plate can be used with many different core boxes. The holes in the plate, which do not require blow tubes, are filled with vents.

An important feature in the con-

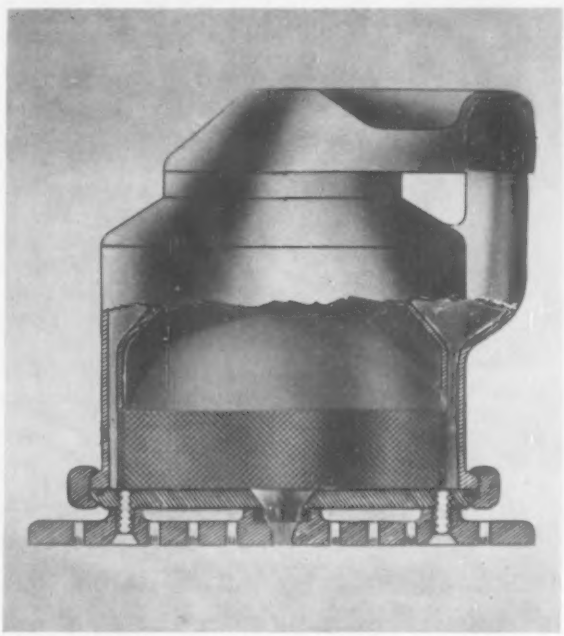


Fig 19. Introducing air through screened inner liner reduces channeling by agitation in magazine.

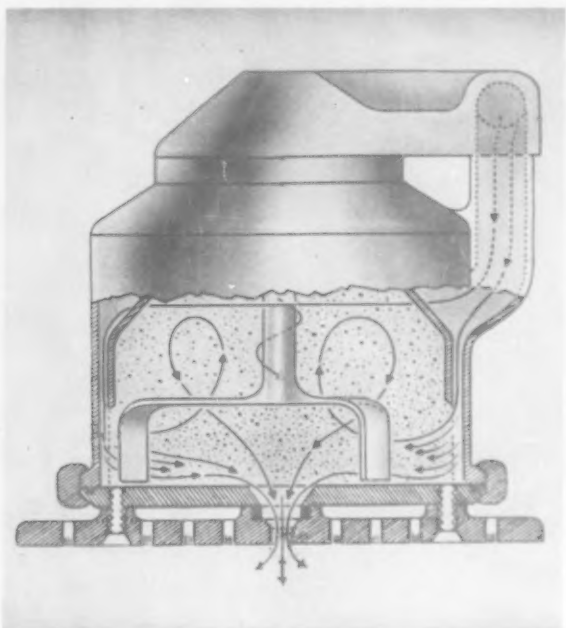


Fig 20. Continuously rotating paddles may be used to break up channels and keep blow plate covered.

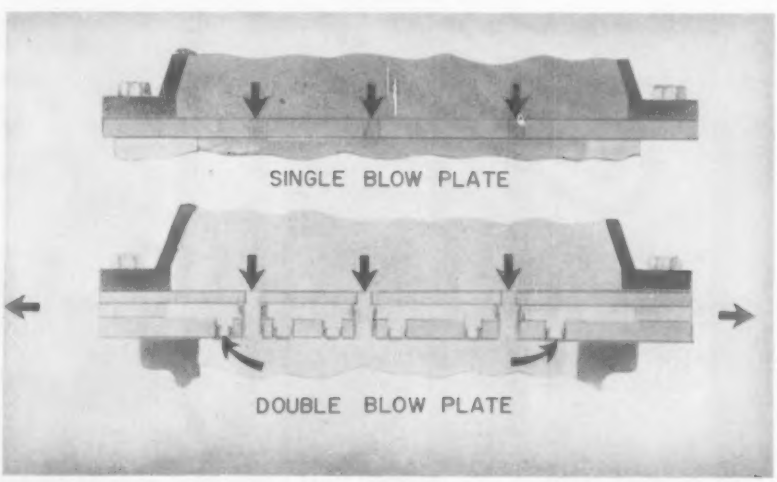
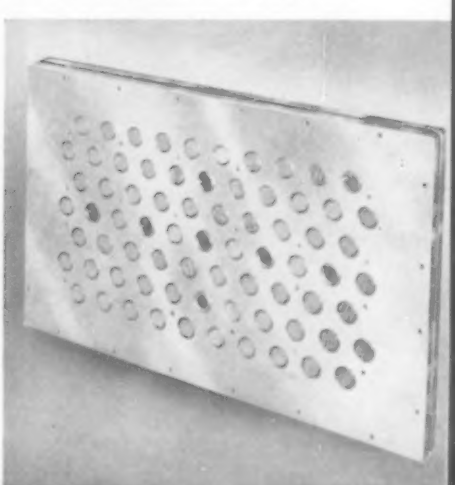


Fig 21. The single blow plate seals the sand magazine and directs the sand into core box. The double plate provides more venting.

Fig 22. Universal plate permits versatile arrangement of tubes, vents.



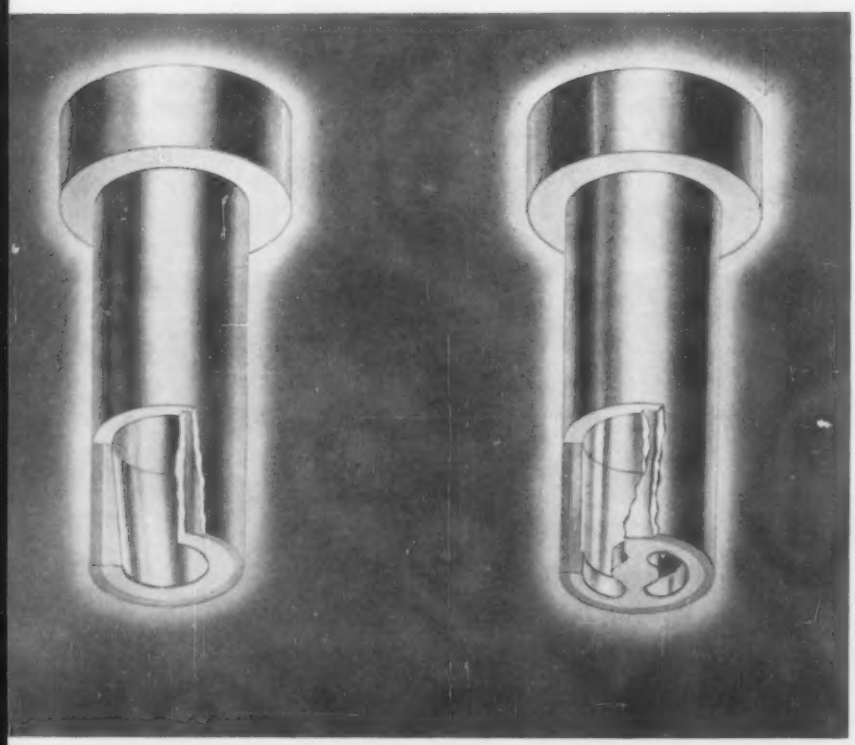


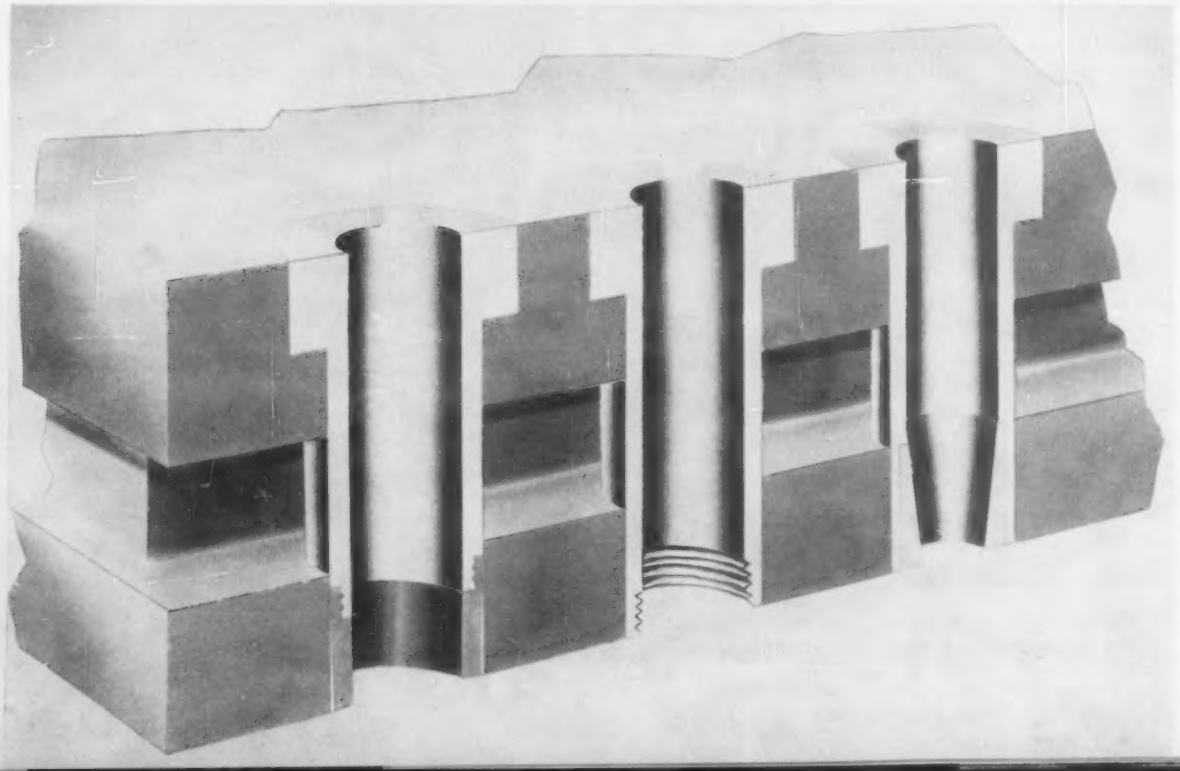
Fig 23. Blow holes may be round or slotted. They may be as large as possible without dumping the sand or small so as to spray sand.

struction of good core blowing equipment is the size and placing of the blow holes (Fig 23). There are several schools of thought on this subject. Some authorities claim that many small holes produce better results than a few large holes. Others claim the holes should be as large as possible without dumping the sand. Those favoring the small holes believe the sand is sprayed at a greater velocity, getting into difficult corners and packing much better. As shown here, it is not necessary to use a round blow hole. Slotted holes have been used with success in many applications.

The cross section of Fig 24 shows the blow tube. The use of a tube is important because it can be replaced when worn out. Without the tube, the hole in the blow plate would be worn by the sand blasting effect of each blow and the plate would have to be replaced. It is obviously more economical to replace tubes than blow plates.

Some bushings are lined with

Fig 24. Cross section showing three different blow tubes designed to break and clean at core line.



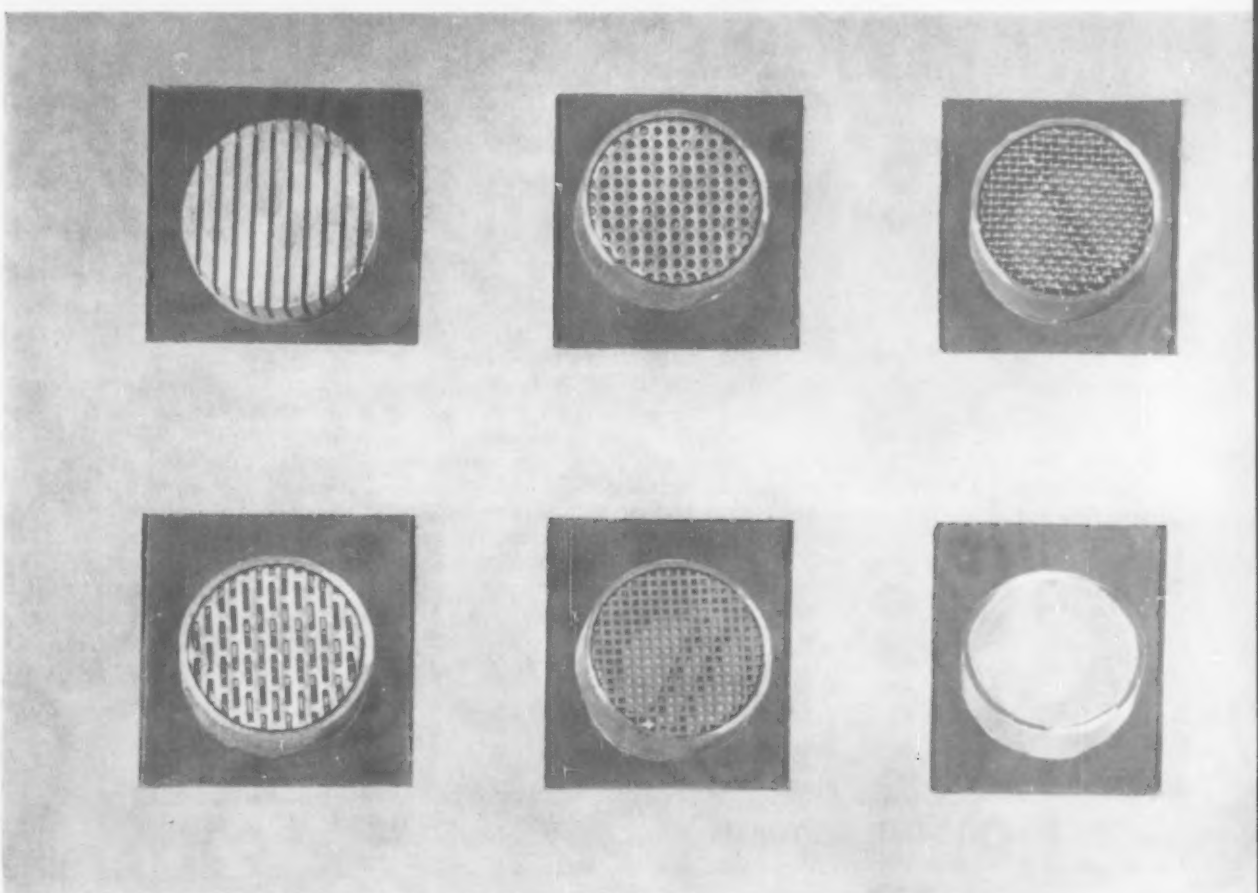


Fig 25. Vents may be designed in a variety of ways. Note the 150 mesh screen vent in lower right.

rubber or plastic or equipped with an adaptable sleeve. Others use a simple short piece of steel or brass tubing. When properly installed they also serve the purpose of providing an air tight connection between the blow plate or vent plate and the core box.

The bushing should break the sand cleanly and evenly at the core line to save extra cleaning labor. This is done by having the bottom of the blow tube taper off to the core line by means of a rubber or steel insert as shown in the cutaway sections in Fig 24. Another method is the use of a straight tube with the bottom section tapped. The threads then help to break the sand cleanly.

One manufacturer of core blowers recommends a ratio of six core box vents for each blow hole of equal size. However, it is seldom possible to find room for that many vents in the core box. Most cores are blown successfully with a minimum ratio of three vents for each blow hole of equal size. In very small cores, the ventilation at the parting is sometimes sufficient to permit the blowing of the core without additional venting.

The same manufacturer has found that at approximately ⅝ in. diameter the comparative effectiveness of screen type and slotted vents is approximately equal. Below ⅝ in. diameter the slotted vents are the most effective. Above ⅝ in. diameter, the screen type vents become more effective.

It is interesting to note the 150 mesh screen vent shown on the lower right of Fig 25. This screen was developed for use with extremely fine sands used in the "D" process. Foundrymen have found this screen stays exceptionally clean during several hours' use.

Another disadvantage in the use of screen vents is the tendency of the screen to blow down and leave a slight lump on the core. The slotted vents shown on the left hold their shape better and last longer but are more difficult to keep clean. Good practice suggests the use of screen vents on print sections of the core. However, they may be used in other areas where the lump will not affect the quality of the core or casting.

NEW PRINCIPLES

The goals are less man hours, less skill, less investment. Here are trends toward these ends

Our present core blowers propel, or blast the sand into the box. Satisfactory results can be obtained when each grain of sand is completely surrounded by air. A close examination of this principle concludes that it is similar to sand blasting. The core boxes are consequently subjected to severe wear. The very nature of this operation dictates the use of an abrasive-resistant core box, costly to build and costly to maintain.

To minimize this condition, new principles of core blowing are being developed. The shooting principle recently introduced in Europe may be an answer. This operation uses only a small, measured amount of compressed air in the sand magazine. Due to the large size blow valve the air is supplied instantaneously and the sand is extruded into the box. In other words, the sand is sufficiently accelerated in a body so that it fills the box completely and uniformly. Theoretically this should result in even strength values throughout the core and render uniform permeability.

There has been considerable interest in this principle of core blowing. In fact, a few American manufacturers have incorporated some of the shoot principles in their newer machines.

As suggested by the Sand Committee of the American Foundrymen's Society, the new principle

Fig 26. A new design for core shooting offers promise of many advantages over conventional ways. The shoot machine uses less air, core box wear is hardly measurable, venting problems are less.

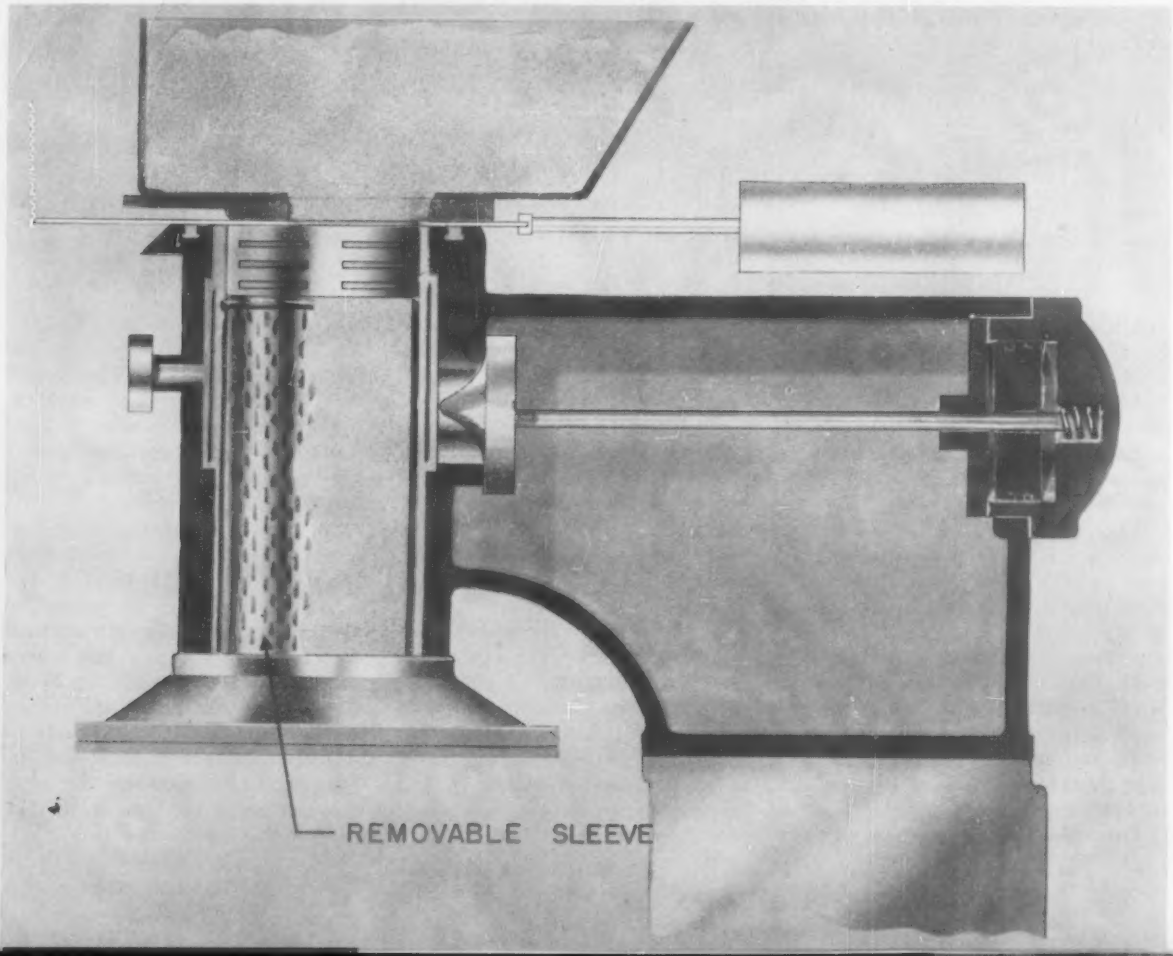


Fig 27. Cores for cylinder blocks, cylinder heads and manifolds were blown with resin-bonded sand.

will be reviewed. The following discussion, however, is not to be construed as a recommendation favorable to any particular machine.

The reported advantages of the shoot machine, Fig 26, as compared with the conventional core blowers, can be summarized as follows:

Since the air supply valve is closed during the blowing cycle, only the air from the reservoir expands on the column of sand. This principle requires an extremely fast and very large air opening, so that in a fraction of a second the entire force of the air from the reservoir works on the sand to accelerate it very rapidly into the core box. Thus, the consumption of compressed air is at a minimum.

A reduction in the amount of air required to blow cores is very important to reduce core room costs. The sand magazine is provided with a slotted cylinder sleeve, thus the air from the shoot valve acts through the holes in the sleeve reducing the friction of sand flowing down the cylinder.

A reported wide range of core sand mixtures can be used.

Core box wear is claimed to be hardly measurable, in fact, it is reported that wood core boxes are used in a number of applications.

The core box is not under airline pressure. Thus, venting, which can cause serious difficulty in conventional blowing, is considered very simple when using the shoot principle. In fact, only the atmospheric air present in the core box must be vented. This is often accomplished by venting the blow plate, or drilling a hole in the trouble spots of the core box to allow the air to escape.

It is my opinion that these principles are fundamentally sound and should be incorporated in our future core blowers.

While discussing new developments, I want to mention some of the relatively new techniques that are being used at the Ford foundries, (Fig 27). We have reached some degree of success in blowing several large cores for the cylinder block, cylinder head and intake manifold with resin bonded sand.

The use of resin bonded sand for blowing shell cores and shell

molds certainly has its place in the foundry industry. In my opinion, further cost reduction of resins is necessary to accentuate the competitive advantage of shell cores and molds.

Based on the work we have done with the CO_2 process, we feel it constitutes an additional challenge to blowing resin bonded sand. Sodium silicate bonding of sand is not new by any means, having been used in the manufacturing of grinding wheels, lost wax process, and as a clay deflocculant.

Phenolic resin and sodium silicate bonding of sand are just two of the recent developments in the foundry industry. In order to maintain our competitive standing in modern industry we need definite and specific objectives. In our opinion, these are the principle objectives of core blowing engineering.

We must work toward a reduction in:

- Skilled core makers
- Physical effort
- Initial investment
- Maintenance costs

We must work toward an improvement in:

- Dimensional control
- Flexibility of equipment

And finally, we must work toward an increase in:

- Production per man hour

In order to make longer and more rapid strides toward these objectives more help must be forthcoming from our machine manufacturers. They will have to develop machines and techniques that will make possible blowing more intricate cores and blowing one piece cores that are now being assembled.

Considerable emphasis has been placed on building shell making machines, while comparatively little has been done in developing equipment for blowing shell cores or blowing shell molds. In addition, much more could be done toward expanding the CO_2 process.

In too many cases the research in developing new machines has been left up to the foundries. There is a very lucrative field for the manufacturer who will develop the core blowing machines needed to further our objectives. The rapidity of these advancements will hasten the reduction in casting costs.

As foundrymen, we are responsible for producing good castings at the lowest possible cost, not engineering machines. Foundrymen, however, must be ready and willing to accept the new ideas. New designs won't help if they are not accepted in a spirit of cooperation.

A further word of caution to foundrymen – the more technical and complicated the manufacturers make core blowing machines in order to gain the foregoing objectives, the more skilled the foundry maintenance people will have to be.

Machine manufacturers have the knowhow to develop new techniques. Without limiting themselves exclusively to the following fields they should direct their major efforts toward the realization of these technological improvements:

- Investigate the diaphragm principle of core making and come up with positive recommendations as to its applications or the practicability of eliminating completely the use of air.
- Look into the possibility of exerting a negative pressure on the core box during the blow cycle. Conceivably, a better core would result. In any event, constant improvement of venting techniques should be sought.
- Put increased effort into the development of the techniques of blowing hollow cores.
- Further the CO_2, or any other process to eliminate baking, making it possible to position the core machines closer to the molding line and thereby eliminating costly core handling systems.
- Eliminate the noise problem of exhaust valves and vibrators connected with the core blowers.
- Extend every effort to develop new ways and means of minimizing manual labor and fatigue.
- Incorporate good safety practice and ease of maintenance in any new developments.

If sand castings are to maintain their competitive position in modern industry much greater emphasis must be placed on research and technological improvement.

The seriousness of this situation is brought out by the fact that permanent mold and die casting processes dominated light metal foundry operations last year. Aluminum die casting shipments increased 45 per cent while the gain in sand casting was a little over 8 per cent.

In gathering this information the AFS sand committee had several meetings with various manufacturers' representatives. We received valuable assistance from them at meetings, from their letters, sketches, and drawings. It was gratifying to see the major core machine manufacturers engaging in this exchange of information even though many controversial opinions were expressed.

Engineered Castings Show Aimed at Designers

Castings exhibits are part of 3-point approach to educate design engineers

Rules for exhibitors have been defined and applications for exhibit space are now being accepted for the first AFS Engineered Castings Congress and Show to be held May 6-10 in Cincinnati. The announcement came from W. N. Davis, Exhibits Manager, who said that exhibit space will be allocated shortly after January 1, 1957.

Exhibits are being strictly limited to only four classes of exhibitors, Davis said. They are:

1. Companies producing metal castings for sale.
2. Manufacturers of laboratory, quality control and testing equipment.
3. Producers of metals and alloys for quality castings.
4. Manufacturers of all types of patterns and pattern materials.

"We regret the necessity of turning down exhibitors of other types of materials and equipment, many of whom have already applied for space," Davis declared. "But we have no alternative under the rules for acceptable exhibits which have been set down by the AFS board."

The purpose of this AFS-sponsored Congress and Show is to promote the castings industry by emphasizing engineered castings. The technical program will also lean heavily toward engineered castings, and will include discussion of such problems as quality control, design of castings and sale and marketing of castings.

The show will be heavily promoted to design engineers. Design engineers are the men who design the nation's major assemblies of machinery and manufactured products. They are the men who specify what components will go into a given assembly, and who determine whether a given part, for example, will be a casting, a forging, a stamping, or a machined part.

The AFS Congress and Show will seek to reach design engineers by at least three approaches:

- By a technical program heavily oriented toward engineered castings.
- By examples of castings and casting problems solved by exhibiting foundries.
- And by attempting to educate the designer on the need to bring his problem to the foundry before he even gets to the pattern stage.

AFS directors believe the show will offer foundries – especially smaller foundries – an unprecedented opportunity to demonstrate their products to the major buyers of U.S. industry.

"The problem of many small foundries is that they have hidden their lights under a bushel," Davis explained. "Nobody knows what terrific capabilities they may have or what they can actually make. But by bringing design engineers together with foundrymen, and demonstrating to designers just what foundries can turn out, we will have overcome this major hurdle."

Davis believes that the accomplishments of modern castings practice will be a revelation to visiting engineers. The principal foundry trade associations for years have been successfully promoting the advantages of engineered castings in terms of better physical properties, money savings, assembly savings and design simplification. This is the first national exposition held in which such advantages are brought out for all branches of the industry.

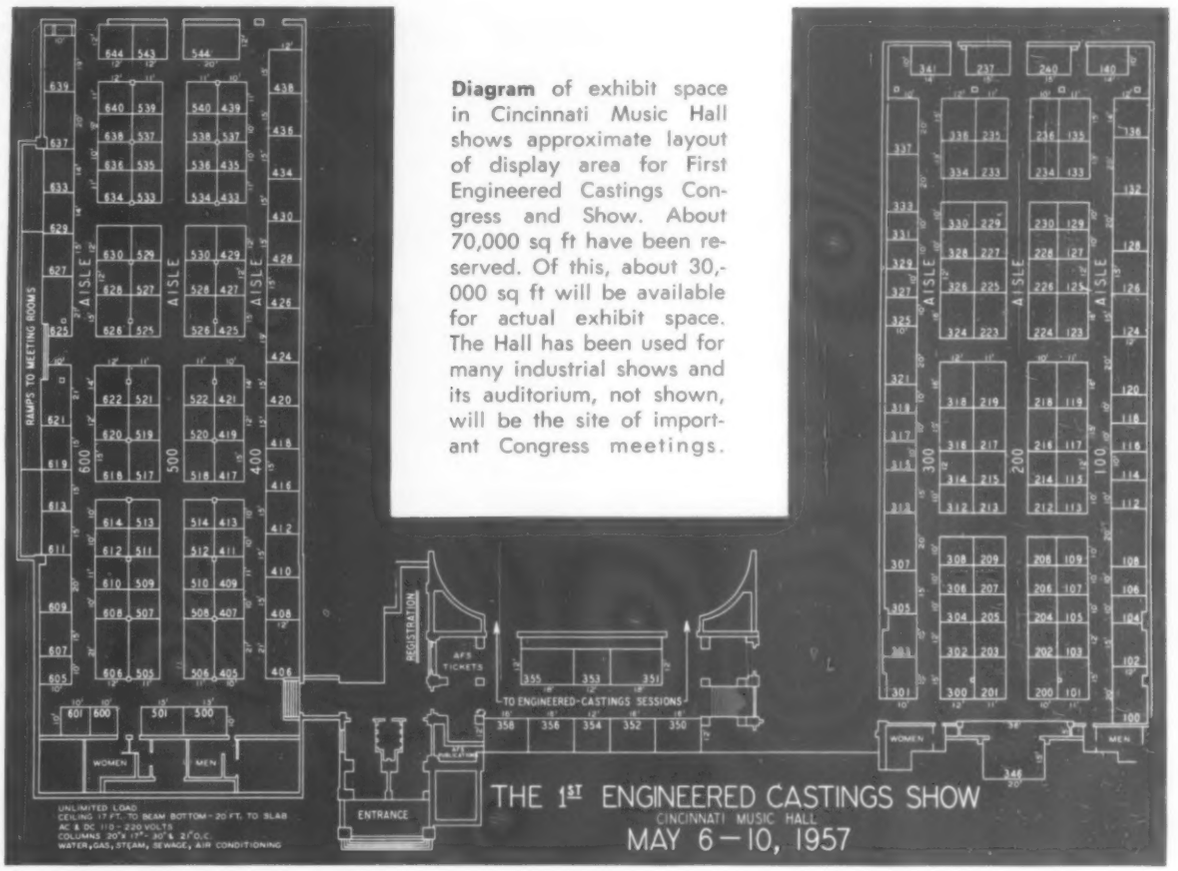


Diagram of exhibit space in Cincinnati Music Hall shows approximate layout of display area for First Engineered Castings Congress and Show. About 70,000 sq ft have been reserved. Of this, about 30,000 sq ft will be available for actual exhibit space. The Hall has been used for many industrial shows and its auditorium, not shown, will be the site of important Congress meetings.

ACCOUNTING FOR QUALITY

J. M. Goldberg/*Process Engineer*
Cadillac Motor Car Div.
General Motors Corp.
Detroit

Running records of past performances can be used as guideposts for current production control problems

Records of past performances light the way to future successes when the records are arranged to follow a system of record-keeping called statistical quality control. The system produces data on products and processes that can be used to predict future results and to measure the quality of present results. When such a system is in effect in a plant, it provides management with specific information for making decisions on improvements and changes in processes.

The "control" in statistical quality control is defined as a "standard of comparison," because the prime purpose of the system is to be a standard and a measuring device. This purpose is fulfilled through the analysis and interpretation of facts and figures.

Because it is necessary to take a number of readings to obtain the figures for statistical analysis, statistical quality control is a useful tool in foundries with high production requirements. Where the problem of producing a quantity of quality castings at the lowest possible cost exists, records of past performances and processes should be a part of good casting practice.

One of the main functions of statistical quality control in a production foundry is to measure the conditions causing casting defects. This measurement requires that processes as well as products be measured and recorded. With these records, the part of a process that causes a product to go out of control can be isolated.

To demonstrate how statistical quality control can be applied in a production foundry, we would like to present a department-by-department tour of the Cadillac foundry.

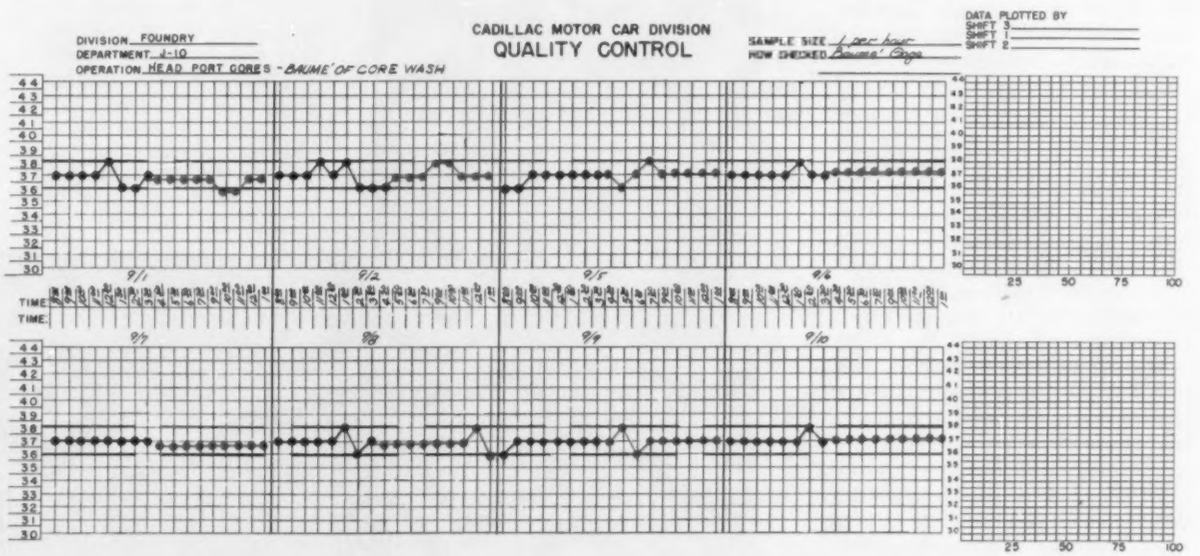
Core breaking charts are used to show per cent of production that is scrapped by each shift.

Core Room, Check Breakage

Incoming materials are tested in the laboratory. Sand is tested for grain fineness and gas evolution. Since the sand mixing and core blowing processes remain almost constant for long periods of time, no charts are kept for these processes. However, the core sand mixes at the core blowing machines are tested regularly for the following properties: green strength, dry strength, moisture, gas evolution, grain fineness, and permeability.

Values for these properties are recorded in tabular form, but not charted, since sufficient information can be quickly obtained from the tabulated data. Corrective action is taken when the measured properties approach the specification limit.

Core breakage, a problem due to the handling necessary, is controlled by charting breakage of six cores representative of high cost and high breakage cores. "Per cent



Baume readings of critical washes and pastes are posted hourly making any variations easy to spot.

of Defective" charts or "P" charts (Fig. 1), are used to show the per cent of core production that is scrapped due to breakage. These charts are plotted by shifts to encourage competition between shifts. The prime purpose of the charts is to bring the problem of core breakage to the attention of the operators in the core room. To accomplish this, the chart for each job is placed in a position most obvious to the operators concerned.

The average per cent defective for the past three months period is shown on the chart by a heavy solid line. The upper control limit is shown by a dashed line. No lower control limit is used since the desired limit is zero. The upper control limit is calculated from the following formula:

$$\text{Control limit} = p + 3\sqrt{\frac{p\,(1-p)}{n}}$$

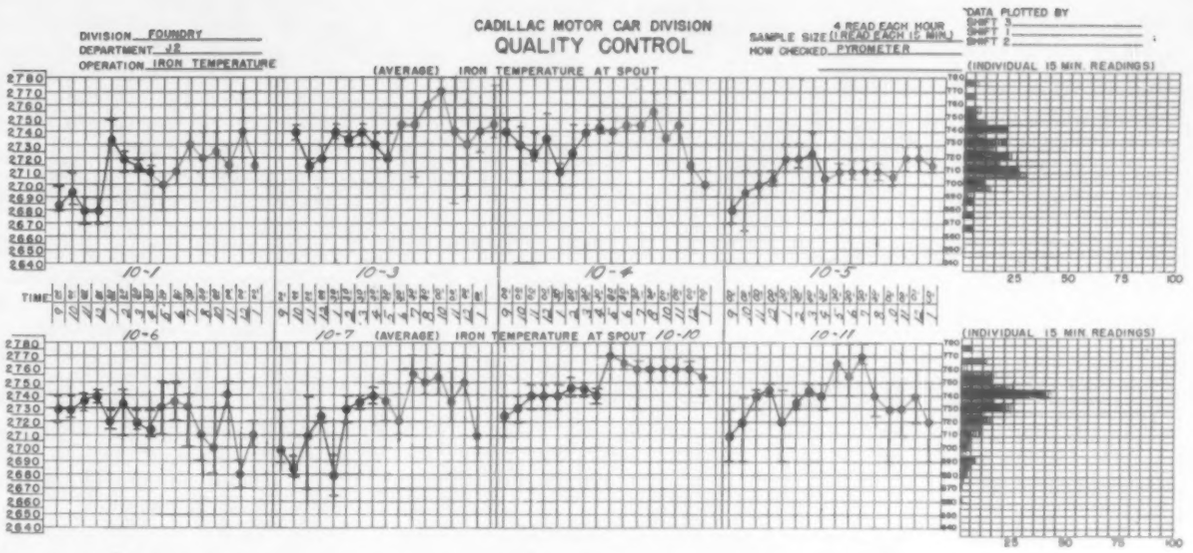
Where p = average per cent defective (expressed as a decimal value)

n = average lot size measured

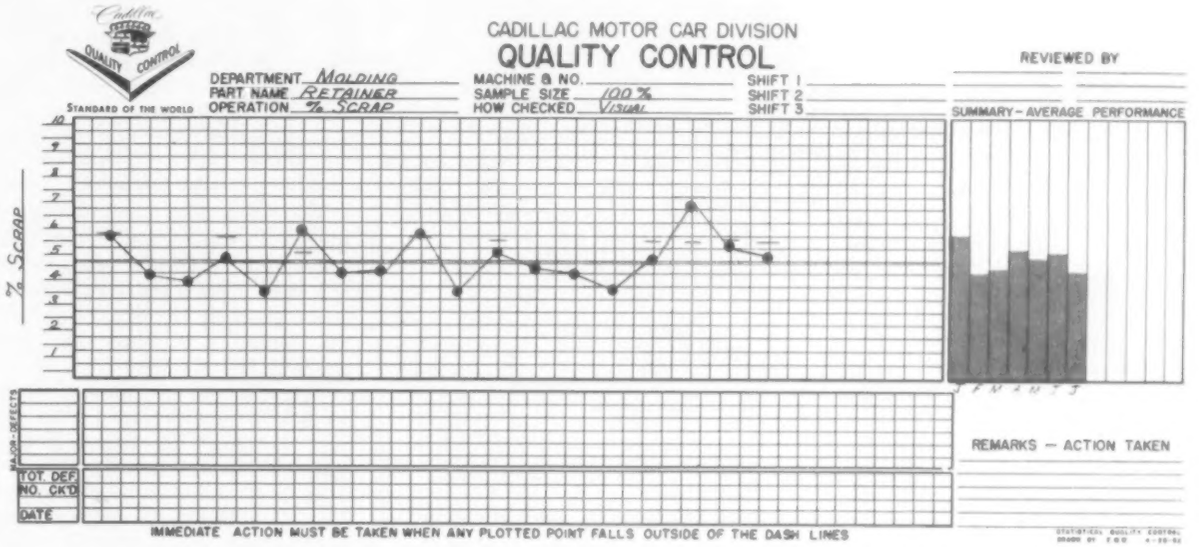
All points which fall below the control limit are shown in green, while all those which fall out of control are plotted in red. A red dot on a chart is often inducement enough to convince the operators involved to improve their workmanship, and thus improve the quality of their product.

Also shown on the charts is a bar graph (Fig. 1) of the monthly history of the scrap for the core charted. This graph is indicative of long term trends.

Another important phase of core room operation which is controlled by charts is the Baume readings of critical core washes and pastes (Fig. 2). Readings in degrees Baume are posted for each batch of paste or core wash every hour. Control limits are set, from past experience, to keep each batch at the density required to give best results. When a plotted point falls out of control immediate action is taken to correct the out-of-control condition. These charts are plotted by the operator responsible for keeping the solutions at the proper densities. Corrective action, when taken, is recorded on the chart.



Temperatures at holding ladle and cupolas are taken every 15 minutes with hourly temperatures recorded.



Per cent defective for each major part made by a particular line is shown on charts.

Melting Department

Incoming coke, pig iron, and steel scrap are checked by laboratory tests to assure that specifications are met.

The base chill of the iron, as it is poured from the holding ladle, is taken every fifteen minutes. At the same time the iron temperature at the cupola spout is recorded.

The average values of these readings are charted (Fig. 3) each hour along with the high and low value for that period. At the right side of each chart is a histogram.

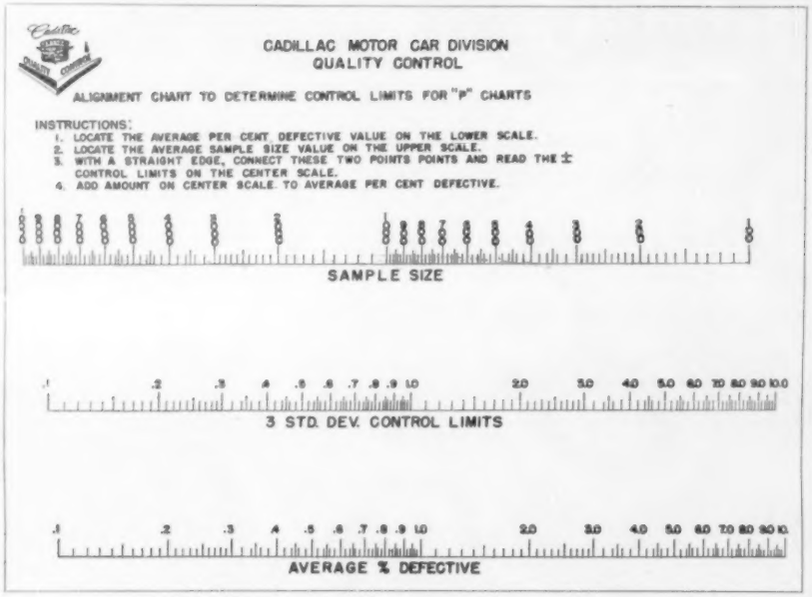
Each individual reading is recorded on the line indicating its value. When five readings are recorded on a line, a square is filled in in solid color. These recordings form a histogram of the readings for a one-month period, the life of the chart.

The histogram is plotted in green for the first shift and red for the second shift, with the green or first shift plotted in the upper half of each line and the red, or second shift, plotted in the lower half of each line. This, in effect, forms three histograms — one for each shift, and one for both shifts together.

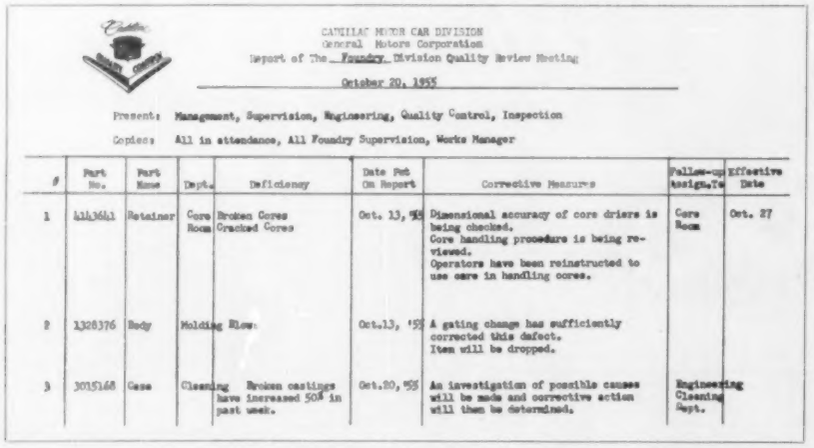
The carbon equivalent, total carbon, combined carbon, and silicon are charted in a similar manner except that the readings are charted every two hours, since they are taken only every thirty minutes.

Manganese and sulfur content of the iron are checked twice per shift, and chromium content once per shift. These values are tabulated but not charted, since the tabulated values sufficiently show any trend toward being out of specifications.

In the cupola control room, blast volume and blast pressure are recorded continually on circular charts which run for a twenty-four


CADILLAC MOTOR CAR DIVISION
QUALITY CONTROL
ALIGNMENT CHART TO DETERMINE CONTROL LIMITS FOR "P" CHARTS
INSTRUCTIONS:
1. LOCATE THE AVERAGE PER CENT DEFECTIVE VALUE ON THE LOWER SCALE.
2. LOCATE THE AVERAGE SAMPLE SIZE VALUE ON THE UPPER SCALE.
3. WITH A STRAIGHT EDGE, CONNECT THESE TWO POINTS POINTS AND READ THE ± CONTROL LIMITS ON THE CENTER SCALE.
4. ADD AMOUNT ON CENTER SCALE TO AVERAGE PER CENT DEFECTIVE.
SAMPLE SIZE
3 STD. DEV. CONTROL LIMITS
AVERAGE % DEFECTIVE

Alignment charts are used to determine variable control limits.



CADILLAC MOTOR CAR DIVISION
General Motors Corporation
Report of The Foundry Division Quality Review Meeting
October 20, 1955

Present: Management, Supervision, Engineering, Quality Control, Inspection

Copies: All in attendance, All Foundry Supervision, Works Manager

#	Part No.	Part Name	Dept.	Deficiency	Date Pub On Report	Corrective Measures	Follow-up Assign. To	Effective Date
1	411361	Retainer	Core Room	Broken Cores Cracked Cores	Oct. 13, '55	Dimensional accuracy of core driers is being checked. Core handling procedure is being reviewed. Operators have been reinstructed to use care in handling cores.	Core Room	Oct. 27
2	1328376	Body	Molding Flow		Oct.13, '55	A gating change has sufficiently corrected this defect. Item will be dropped.		
3	3015168	Case	Cleaning	Broken castings have increased 50% in past week.	Oct.20, '55	An investigation of possible causes will be made and corrective action will then be determined.	Engineering Cleaning Dept.	

Quality reviews are held each week and corrective measures planned.

hour period. These charts serve as an indication of variation in the melting process, and also as an indication of causes of variation in the castings themselves.

Molding Department

The process control charts on the molding lines are of great value, because the molding line processes are closest in time to the finished casting. Every two hours samples of the molding sand are taken from the flasks on the molding machines of each molding line. Each sample is tested to determine permeability, per cent moisture, green strength, and per cent carbon.

One chart is kept for each of these properties on each molding line. The charts are posted once each shift, showing the average value for the shift, and the high and low values. The first shift readings are plotted in green and the second shift readings in red. At the right side of each chart is a histogram where each reading is recorded for the melting department. These charts are most useful in showing shift differentials and trends over a period of days. The foreman is informed of each individual reading immediately. The charts, however, show gradual changes which might otherwise go unnoticed. Other sand properties are recorded in tabular form.

Charts showing the per cent defective for each major part made on a particular line, are displayed at that line (Fig. 4). For the cylinder blocks and cylinder heads, the per cent welded is shown as well as the per cent scrap. For all other parts only the per cent scrap is shown. All charts show only defects chargeable to the molding department.

On these charts, the average per cent defective for the past three-month period is shown by a solid line. The per cent defective is shown by red and green dots; red when out of control and green when in control. Because of the great variation in sample size, variable control limits are used. These limits are determined from the alignment chart (Fig. 5).

The charts for each molding line are grouped together on a well lighted board in a conspicuous place. To call attention to out-of-control conditions, a red light is used beside the charts which require them. Any process changes are recorded on the charts so the effect can be noted. Also shown on each is a list of major defects, as well as a bar graph of past monthly performance.

Cleaning and Inspection

The cleaning room, which is responsible for water testing for leaks, keeps charts showing the per cent of leaks for parts tested, as well as charts showing the per cent tested for those parts that are spot checked.

Similarly, the inspection department keeps charts showing the per cent of pieces magnafluxed, and tested for Brinell hardness.

Average and range charts are used to control the Brinell hardness readings for each part. On these charts the specification limits are used rather than the standard control limits. Sample size varies from 1 per cent to 100 per cent of production, depending on the specifications. These charts are the basis for accepting or rejecting a lot because of improper hardness.

Foundry Overall

Charts showing the total per cent scrap for each part are posted daily by the inspection department, as are charts showing the per cent welded for the parts that are welded. Along side each chart is a monthly history of past results.

A master chart in the superintendent's office shows daily, the man hours lost per 1000 productive man hours due to scrap in each department, as well as in the foundry overall. This chart is most useful in indicating lost dollars due to scrap, since the times in hours are calculated from the routing times of each part. These routing times are the major contributors to the cost of the parts.

Quality Review Meetings

Once each week a quality review meeting is held. Present are representatives of management, supervision, and the quality control group. Out-of-control conditions are discussed as well as other items which warrant attention. Corrective action to be taken is determined, and the follow-up is assigned to a person or group. At the following meeting the person or group to whom the follow-up was assigned presents a progress report on the action taken and the results. Any item once brought up at a meeting is considered each week until satisfactory results are obtained. Minutes of these meetings (Fig. 6) are distributed to all persons concerned with quality in the foundry.

In setting up a statistical quality control program, several factors should be considered. It can safely be assumed that the overall goal of all foundry statistical quality control programs is to promote the production of high quality castings at the lowest possible cost. However, the goals of individual phases of the program will vary. Controls must be set up to facilitate attaining the goal for which the control is intended.

First, it is necessary to decide what is to be controlled. Next, the type of control chart that is best suited for the particular application must be selected and placed in a location convenient to the people concerned with it.

Sources of information for data to be used in the work should be reliable. Inspection departments usually can supply sufficient information for control of casting defects. However, in certain process control applications, data may necessarily be gathered by production employees. In such cases, supervision should periodically check the data to assure recording accuracy.

BEFORE YOU BUY—
ask the man who runs it

JOHN TAYLOR / *Vice President*
Norris & Elliott, Inc.

How often has your new equipment gone wrong because you didn't pre-sell it to the man responsible for results?

The purchase of new equipment is an area where little, if any, recognition is given to the influence of the human factor. New equipment purchases are of major importance to any company and are made only after considerable thought is given to capacities, depreciation, initial cost, return on investment, etc. However, this is only part of the complete project, just as actual installation is part of the project. Either during purchasing, or between purchasing and installation, lies an area of human relations which is vitally important to the success of the purchase.

Therefore, the second step in the procedure of buying equipment should be, and is, dealing with the human factor. Many executives refer to this phase as the "conditioning period" or the selling job that may be necessary on those who are to be responsible for its operation.

When a new piece of equipment is sold to a company it is done with the sincere belief that it will produce the quantity and quality for which it was intended. The purchaser is also convinced that the equipment will produce the desired results or he wouldn't be the purchaser. At this point the seller and the buyer are in accord.

Now, it is self-evident that the foreman or supervisor cannot be enthusiastic about new equipment for which he is to be responsible if a sincere effort has not been made to sell him on its merits. In many instances his attitude is one of complacency. He accepts the new equipment because the boss ordered it. Inwardly he may resent the new equipment because he had little to say about its selection, or because he may have heard from miscellaneous sources that the equipment is overrated.

This kind of condition exists in many plants and is the underlying reason why many companies become dissatisfied with new equipment. They may be told by the foreman that the equipment is no better than the old equipment or that it does not produce the expected results. In many cases it then becomes necessary for the actual purchaser to go into the shop and try to prove the value of the machine in order to justify his own convictions. Failing this, expert help is usually requested from the equipment maker.

Assuming the representative of the equipment company is successful in demonstrating the merits of the machine and the plant is now satisfied with its purchase, there is still the item of wasted time and expense involved.

This influence of the "human factor" unfortunately gets little recognition in most purchasing. Why not? The supervisor can save the company considerable money if he is "sold" on the new equipment before it arrives, or if it is the kind and size of equipment which he believes will do the kind of job required. It is only reasonable to assume that maximum efficiency of a machine can be obtained only when the operation of the equipment is fully understood and the desire to "make the machine talk" exists in the mind of the person responsible for its operation. This basic point, then, is the key to obtaining the anticipated results.

It is true that the operating personnel at plant level are normally not in a position to interview the sales representatives of equipment manufacturers. By the same token, unless there is extremely close coordination between operating personnel and the person who does the purchasing the latter may not be familiar with such important detail as depth of foundation, head room, sand supply, etc.

It is also true that operating personnel are not in a position to decide on the economics of the purchase of new equipment.

Some individuals may insist that a good loyal supervisor will accept any piece of equipment purchased for his department. This is true but it isn't the whole truth. He will accept the machine but the question is—how? Again, it is generally agreed that most loyal supervisors will try to use the machine effectively because the boss purchased it. The remaining loyal supervisors may not try too hard to use the equipment effectively just because the boss purchased it and they were not consulted. As one goes from the loyal supervisors to the ones whose loyalty is just average and then to the prima donna type, the situation becomes even more aggravated.

In one foundry a study was being made on a large molding floor for the purpose of increasing production. A slinger was being used on practically all molds and from casual observation it was concluded the slinger was running most of the time. An activity study was started to determine the maximum output of the machine but the study also revealed some unexpected facts.

It revealed that the slinger was being used purely as a flask filler —not as a slinger. Casual and very cautious conversation with the immediate supervisor revealed some interesting viewpoints, which later proved to be very biased. The gist of his comments is as follows:

1. The boss purchased a used machine without even mentioning it to him. He first knew about it when it arrived.
2. It was the wrong type and didn't have the capacity required.
3. It wouldn't ram a mold hard enough.

Careful analysis of his comments, and a study of all influencing factors, revealed that the only correct statement was the first one. In this case, the only possible conclusion was that the supervisor didn't make a real effort to use the machine effectively because he was peeved about the manner in which the machine was introduced. To make matters worse, it was learned that the supervisor knew very little about slingers and had never asked for assistance, either because of pride, his peeve, or both.

A similar example occurred in the core room of a medium-sized foundry. A new core blower was purchased for the purpose of blowing the larger cores that had been made on the bench. The machine was purchased and installed in much the same manner as the previously mentioned slinger except that the supervisor was told it was being delivered.

Analysis of the machine's activity revealed it to be working about two hours per day on rather simple cores, while a considerable amount of work still being done on the bench could have been done more economically on the machine.

General conversation with the supervisor of the department revealed his reason for not putting more work on the machine. He knew—or rather, thought he did—that the machine wouldn't blow the more complicated work. After further questioning, he readily ad-

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mitted he hadn't really tried any complicated work just because he knew it wouldn't work. There were no basic facts for this kind of an answer and since he didn't seem to be harboring any peeve toward the president of the company it seemed reasonable to assume that some other reason existed.

Further conversation finally revealed the answer. The supervisor's reasoning was based not on his own experience but on that of a friend who was core shop foreman in a nearby foundry. The latter was using a core blower of the same make and size but it had been used for many years, was in poor condition, had none of the new improvements recently added by the manufacturer and did not have a sufficient supply of air.

When it was explained to the supervisor that the new machine had many improvements over the old one and the air pressure available at all times was 50 per cent greater than that available for the blower in the neighboring foundry, he became interested in transferring more work to the machine and did so successfully. Later it was learned that these two supervisors were close friends and, because of their exchange of ideas, the second supervisor had requested his company to purchase a new blower.

These two examples illustrate cases where recognition of the human factor could have saved considerable money. In the first instance, the lack of recognition caused the supervisor to carry a peeve against top management. His responsibility for molding operations had been completely ignored and it had hurt his pride. In the second case, the lack of recognition had caused the supervisor to accept the machine under misconceived ideas.

In these situations the fault is mainly because management does not follow through. In all fairness, of course, part of the fault is because the supervisors took the wrong attitude. Yet if the time had been taken to explain and sell the merits of the new equipment little if any follow-through would have been necessary.

The condition should be viewed much as other problems dealing with human relations—discover the

basic reason behind the poor attitude toward this new equipment.

Even ruling out the prima donna, or the few cases of below average loyalty, it is necessary that recognition be given to the extent of the responsibilities of the supervisor. Many of these are defined by management and many are assumed without definition, but the fact remains that the supervisor is held fully responsible for the results attained by his department.

He is held responsible for the conduct and output of his labor force, and for the production, maintenance, and operating efficiency of his equipment.

If management recognizes its own policy of holding the supervisor responsible for getting the optimum results from the equipment in his department, then it will recognize the importance of making sure that the supervisor is thoroughly sold on the new equipment and believes it will do what it is supposed to do.

If management does not recognize the value of holding a man responsible for things in which he believes, and purchases equipment which is not liked for one reason or another or is the wrong capacity, then the mental reaction of the supervisor is one of resentment.

He is being held responsible for a piece of equipment which, in his mind, is not right. Therefore he shouldn't be held responsible for the results. He reasons, and rightly so, that if he is to be responsible for something he should have some opportunity to express his opinions before the equipment arrives and preferably before it is purchased.

Industrial engineers, and particularly consulting engineers who get into scores of plants see these conditions quite often. Where they exist they usually permit the engineer to produce results more quickly simply by proving to the immediate personnel that better results can be obtained.

Some executives are aware of this problem and make every effort to minimize or eliminate it from their organization. Those who don't, or those who feel that they should spend their own money as they choose, will benefit greatly from a change in procedure.

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DECARBURIZATION —How and Why

NICHOLAS J. GRANT /
Associate Prof. of Metallurgy
Massachusetts Institute of Technology

Thin sections and rapid cooling can put brakes on damaging effects.

Decarburization is the process whereby carbon is removed from the surface and sometimes to considerable depth from steel either during heat treatment, during hot working, or during the cooling of a casting from its solidification temperature.

Decarburization can have damaging effects on many different types of properties. These include the following: (a) decreased surface hardness and decreased wear resistance; (b) incorrect or improper heat treating response of heat treatable compositions; (c) decreased endurance limit in fatigue type applications; (d) decreased hardness of surfaces after nitriding, carbonitriding, and chromium plating.

Fatigue life, as measured by the endurance limit suffers more than most mechanical properties except hardness, wear, and abrasion resistance. Table I shows the endurance limit for a Si-Mn and a Cr-V steel as a result of decarburization. These results are for wrought steels.

In particular, a combination of a decarburized surface plus a coarse grain size, which could easily happen in a cast product, would lead to especially poor fatigue values and would have to be guarded against.

Actually, decarburization is a very common type of problem and in many instances has not been serious because one is able to remove the decarburized surface by machining, by heavy oxidation to remove the deoxidized layer or, as is commonly done in the precision casting industry, by recarburization. Of these only recarburization will permit recovery of a casting.

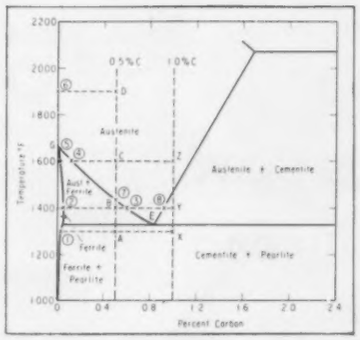

Fig 1. Iron-carbon phases.

Generally, one does not expect that decarburization of mild steel is a serious matter. Low carbon steels are generally employed where ductility is the most important factor and strength is probably a secondary factor. Furthermore, one seldom seeks high hardness or fatigue resistance in soft mild steels which are not heat treated and are used in the as cast condition.

The Role of the Atmosphere. Based on experience gained primarily from heat treating of steels, it has been found that for decarburization to occur the steel must be exposed at its surface to hydrogen, water vapor, carbon dioxide, or oxygen. Furthermore, the last three of these gases can produce oxidation and scaling and if they occur sufficiently rapidly or extensively, have the effect of minimizing decarburization by removal of oxidized layers of metal at a rate faster than decarburization can occur. This removal of a layer of metal as oxide cannot be tolerated, however, in precision investment casting. On the other hand, moist hydrogen (or a mixture of carbon dioxide and water vapor) turns out to be a particularly effective decarburizing mixture. The extent to which decarburization occurs in each type of atmosphere will, of course, depend on the temperature, on the gas pressure and the types of gases in a gas mixture, and on the time.

The removal of carbon from steel takes place at the metal-gas interface. Continued decarburization requires that the carbon must constantly diffuse from the bulk of the steel to the surface where it will react with hydrogen or with the oxygen provided by water vapor, carbon dioxide or oxygen itself, converting carbon generally to methane (CH_4) or to carbon monoxide, (CO). For decarburization to occur in a casting, and in particular in a hot investment mold, it is unlikely that either hydrogen

TABLE I. ENDURANCE LIMIT, ROTATING CANTILEVER FATIGUE TESTS

Condition of steel	Endurance Limit—psi Si-Mn steel	Cr-V steel
Polished—no decarburization	102,000	93,000
Normal heat treatment (light decarb.)	60,000	71,000
Heavily decarburized	47,000	45,000
CO treatment (slight carburization)	104,000	76,000

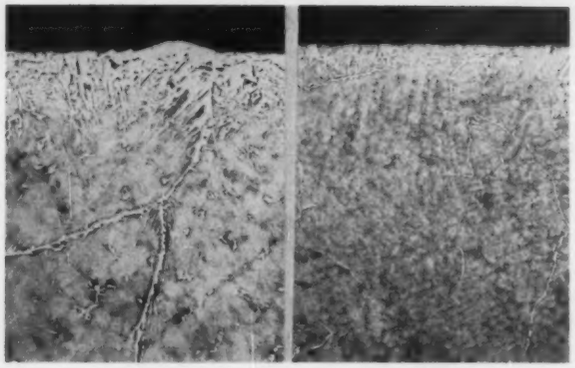

Fig 2. Decarburization is greater in thicker section (left) than in thinner section.

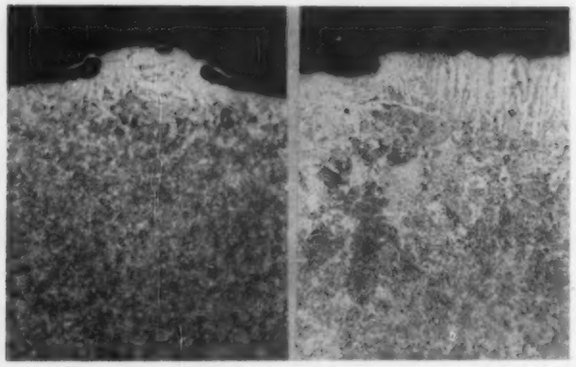

Fig 3. As-cast condition of C 1095 steel shows decarburization at the surface.

Fig 4. Section of cast steel slow cooled in large flask.

Fig 5. Structure of steel rapidly cooled in small flask.

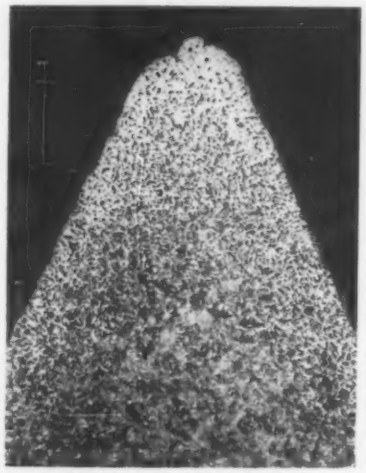

Fig 6. Casting from Fig 4 after normalizing at 1600 F.

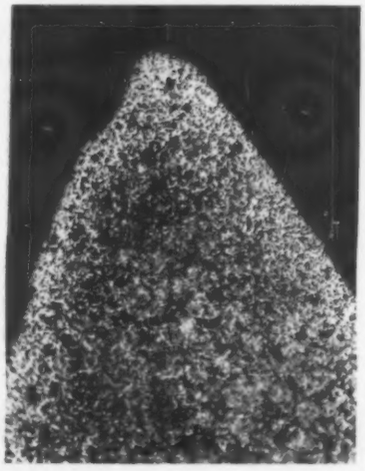

Fig 7. Casting from Fig 5 after normalizing at 1600 F.

or water vapor or carbon dioxide is present initially in sufficient quantities to provide the decarburizing atmosphere. This means that decarburization must come from oxygen in the mold. When one considers the vast amount of surface which is provided by the very fine silica grains in contact with the metal one can easily believe that there is a vast quantity of oxygen present in the mold to provide the decarburization medium. Furthermore, whereas significant decarburization can and does occur in heat treating, at temperatures from approximately 1200 – 2000 F, the cooling of a casting, particularly in a hot investment mold, provides a long period of contact time over a temperature range from the melting point of the steel, which would be approximately 2600 F, down to about 1200 F, which is approximately the lowest temperature for effective decarburization to occur.

Undoubtedly, the oxygen initially present to provide decarburization converts to a mixture of oxygen and carbon monoxide, or possibly oxygen, carbon monoxide and carbon dioxide, depending on the quantity of oxygen available. To best understand the nature of the decarburization process it would be desirable to utilize the well-known iron-carbon diagram (see Fig 1), and to consider two types of steels, one a hypo-eutectoid steel, containing less than about 0.8 per cent carbon, and the second a hyper-eutectoid steel, with about 0.8 to 1.7 per cent carbon content. These two classes of steels represent compositions in which the structure on normal slow solidification will be ferrite plus pearlite (hypo) or cementite (Fe_3C) plus pearlite (hyper).

For the purpose of discussion, primary consideration will be given to decarburization which occurs at very high temperatures, namely above about 1680 F. This temperature region is the one in which the most severe decarburization takes place during the very slow cooling of the hot investment flask. The steel pouring temperature varies from as high as 3100 to 2800 F, the flask temperature varying from about 1600 to 1800 F. There results a fairly rapid temperature drop as the metal loses heat to the flask and the atmosphere. The temperature of the silica refractory may rise to 2200 to 2400 F as the metal transfers its heat. Further loss of temperature from about 2200 to about 1680 F (the austenitic region in low carbon steel) is very slow, and it is at these high temperatures that much of the decarburization takes place. Consideration will also be given to decarburization taking place between 1330 and 1680 F, the region in which alpha can form, and also to a temperature below the eutectoid temperature of 1330 F.

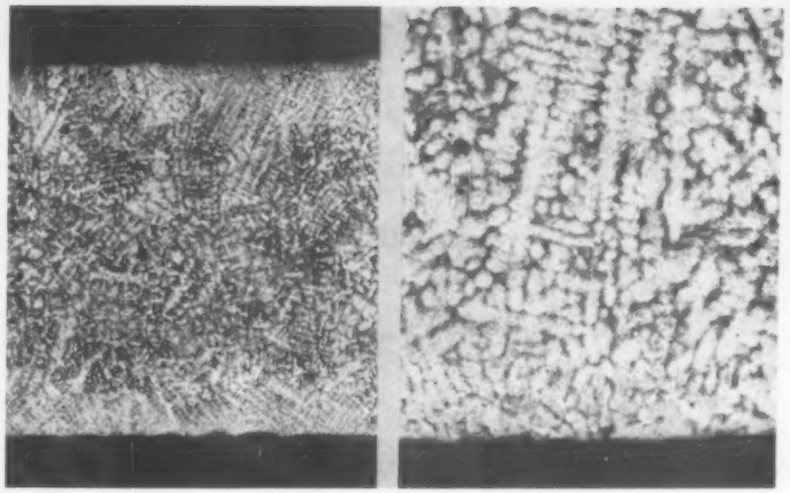

Fig 8. Photomicrographs of 1/4 in section (left) and 1/16 in section (right) show reduced decarburization with a thinner cross section.

While decarburization in the cooling of an investment casting will have proceeded to a significant extent above 1680 F, additional decarburization will take place down to about 1200 F. In the examples to follow, however, the cases will be treated as though decarburization took place only at the lower temperatures, a situation similar to what happens in heat treating at these same temperatures.

For these examples let us consider Fig 1, which is a schematic presentation of the iron-carbon phase diagram. Let us first define a number of the phases which exist in the iron-carbon diagram. Alpha iron (ferrite) is the body-centered-cubic form of iron (magnetic) in which the solubility of carbon is low (maximum of about 0.035 per cent) and the diffusion rate of carbon is slow. The austenitic form of iron (gamma) is the face-centered-cubic variety (non-magnetic) in which the solubility of carbon is large, being of the order of 1.7 per cent at a temperature of about 2065 F. In addition to the high solubility of carbon in austenite, the diffusion rate of carbon is also high. Pearlite, the only other structure which will be considered in this discussion, is made up of the alternate plates of the low carbon alpha iron, and of cementite, Fe_3C, containing over 6 per cent carbon.

Decarburization of Austenite. Let us now consider the first case, namely that of a steel containing 0.5 per cent carbon, which has solidified and now exists as a purely austenitic structure of homogeneous composition at a temperature of about 1900 F, represented by point D in Fig 1. At this temperature, if one were to remove all of the carbon from the surface of this steel, the structure at the immediate surface would remain completely austenitic, represented by point 6. In contact with oxygen, the carbon will react with the oxygen at the surface to form carbon monoxide, and will thereby reduce the carbon content of the steel at the surface.

In an investment mold, there will not be enough oxygen present to result in scaling which would remove metal as fast as it decarburized. Under these circumstances, the carbon, as it is depleted at the surface, is replenished by the diffusion of carbon from the interior of the casting at a rate which depends on the time, the temperature

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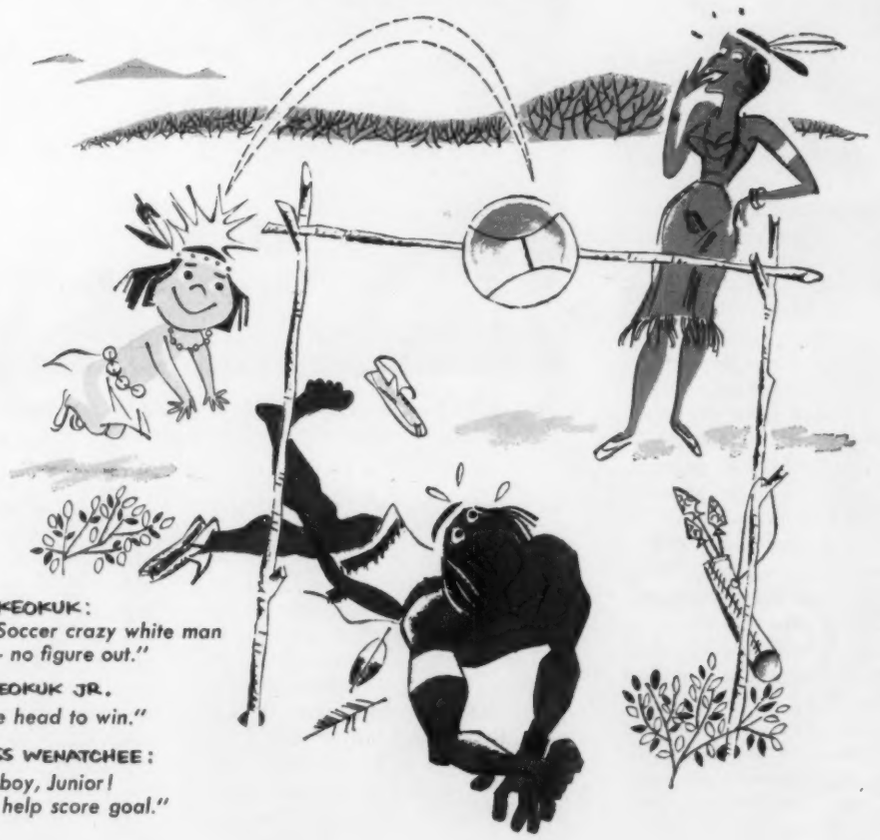

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and the steepness of the carbon gradient. At first the carbon being supplied to the decarburized surface has only a short distance to travel, and the supply of carbon is large; but with further decarburization in this high temperature range, the distance that the carbon must travel from the high carbon area (0.5 per cent) to the low carbon area, becomes greater and the concentration gradient becomes less.

Under these circumstances, as the steel cools, the interior part of the casting reaches point 7 on curve GE, and begins to precipitate ferrite containing less than 0.03 per cent carbon, as indicated by the curve GO. The surface of the casting, however, is very much lower in carbon content, and may in fact be as low as 0.01 to 0.1 per cent. On cooling, this surface begins to precipitate ferrite at a point near G. Thus the first ferrite to form does so not at about 1400 but at about 1650 F. This surface ferrite will further decarburize possibly to zero per cent carbon. The decarburization process will then continue on further cooling to the temperature of the eutectoid transformation (1330 F), with increasing amounts of ferrite being formed.

If on the other hand the starting carbon content of the steel composition was 1.0 per cent instead of 0.5, as indicated in Fig 1, the overall process of decarburization would still remain the same. However, it is easy to see that it would take a longer period of time to remove 1.0 per cent carbon as compared to 0.5 per cent carbon for the same time interval in the austenitic temperature range. Furthermore, even as the carbon content at the surface is being reduced, additional carbon will be supplied from the bulk of the casting due to the high carbon concentration gradient to minimize decarburization. Nevertheless, if sufficient time in the austenitic temperature range is permitted, the surface will have shifted in composition toward zero per cent carbon.

Even though zero carbon content is not achieved, but a carbon content less than about 0.8 per cent is achieved at the surface (for example, assume the surface carbon content decreases to 0.5 per cent)

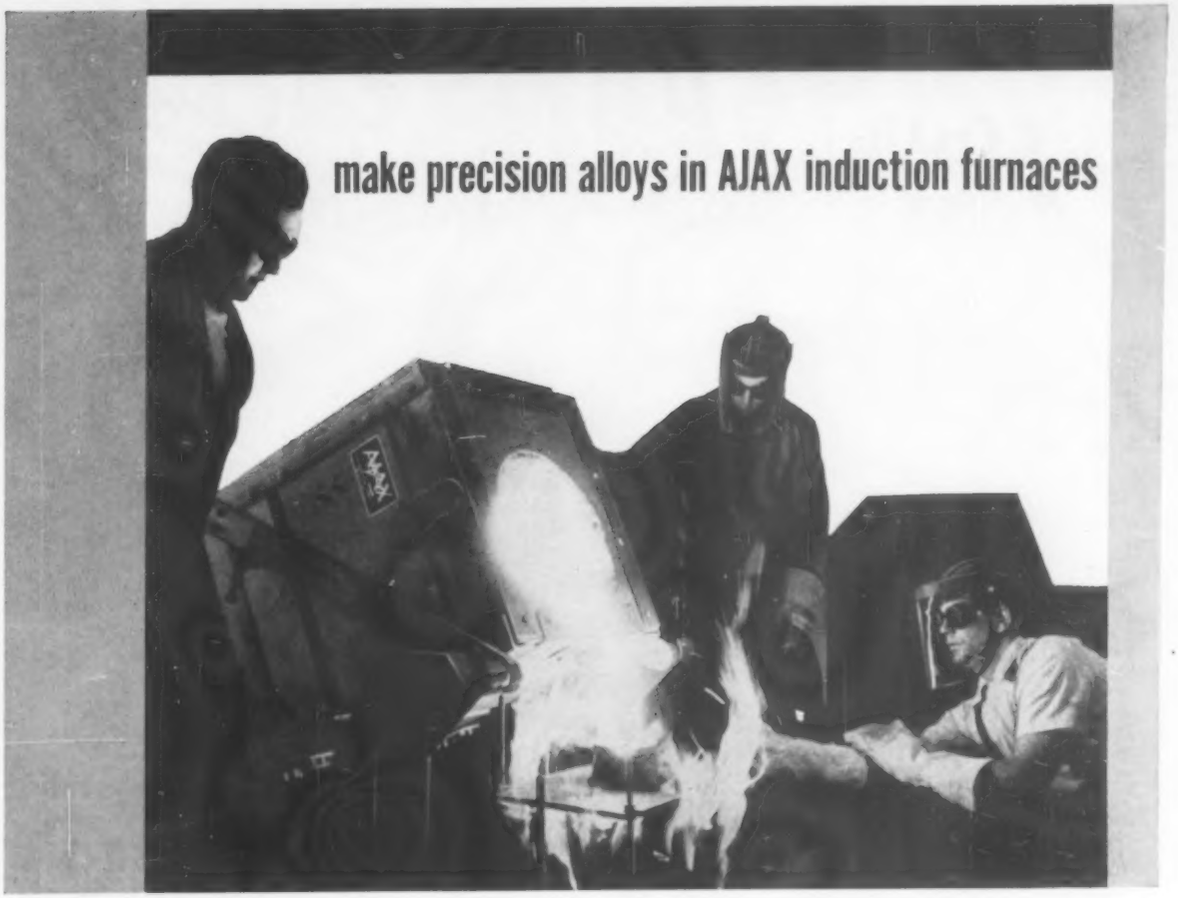
then on cooling, when this surface strikes the curve GE, ferrite will precipitate at the surface and at grain boundaries near the surface. This ferrite on cooling will decarburize further. On the other hand, if no decarburization had taken place, so that the composition of the metal had remained uniformly 1.0 per cent throughout, or if the casting had cooled rapidly, the structure would not have produced ferrite until after cooling below the eutectoid temperature (1330 F).

Since the maximum amount of decarburization takes place after solidification and on cooling as described above, there would be little to be gained to consider the additional decarburization which takes place on cooling at temperatures below about 1300 F.

Instead, let us consider what happens during heat treatment and how decarburization takes place under these circumstances, realizing that on direct cooling of a steel casting small increments of decarburization would take place as described below.

Decarburization During Heat Treating. When a steel of composition 0.5 per cent carbon is heated to a temperature represented by point A, this steel will be composed of the low carbon ferrite plus the pearlite, which is a mixture of the low carbon ferrite and the Fe_3C compound in alternate plates. The Fe_3C plates are assumed to be isolated from each other and surrounded by the ferrite in all instances. When exposed to a decarburizing atmosphere, the Fe_3C plates which are exposed to the atmosphere are of course soon decarburized, and become of the same low carbon content ferrite as the existing ferrite. Further removal of the carbon will then take place by diffusion of carbon from the Fe_3C plates through the ferrite which now exists at the surface of the steel. Because of the low diffusion rates of carbon in ferrite this process will be slow at these temperatures.

If decarburization takes place at a temperature represented by point B, the structure initially consists of a mixture of ferrite and austenite, the Fe_3C phase having been completely dissolved at 1330 F. The ferrite still contains a very limited



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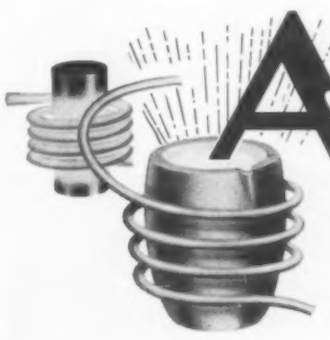

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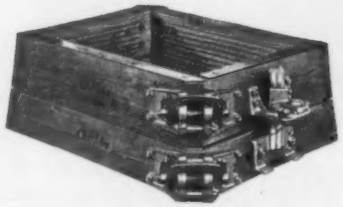

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amount of carbon and the austenite now contains the amount of carbon represented by point 3 on the curve GE. Again at the start of decarburization, nearly all of the carbon will be removed from the surface and there will be produced carbon free ferrite at the surface. Diffusion of carbon will now take place through this layer and will be supplied by the higher carbon content austenite. As sufficient carbon diffuses out of the austenite, next to the ferrite at the surface, the austenite will change to ferrite, and in this manner the depth of carburized material will increase. In this regard the process of decarburization taking place below the eutectoid temperature and above the eutectoid temperature is similar in kind but not in degree. At the higher temperature, B, it is the function of the austenite to supply carbon to the ferrite, whereas at the lower temperature, A, it is the function of the cementite to supply carbon to the ferrite. The rate of decarburization will, of course, be vastly greater at the higher temperature.

Somewhat different conditions prevail at a temperature represented by point C, since at this temperature the 0.5 per cent carbon alloy is 100 per cent austenitic and therefore of a uniform carbon content throughout. Removal of carbon begins, as before, at the surface. However, ferrite will not begin to form until sufficient carbon has been removed from the surface to bring the composition of the surface layer to a quantity less than that represented by point 4 on curve GE. If this happens, decarburization takes place as described at the B temperature. Otherwise the surface will remain austenitic, but of lower carbon content than 0.5 per cent. On cooling, however, the first ferrite which forms will form at a higher temperature as was the case for the continuous cooling of the casting described above, and decarburization will be more severe and the ferrite depth will be greater.

If we again consider the 1.0 per cent carbon composition, the same reasoning must follow which was utilized in considering the case of the decarburization of the casting on cooling from the solidification

temperature. At a temperature represented by point X, there is more cementite present than at point A, and it will be a longer time before sufficient carbon is removed to provide a decarburized zone. Once a decarburized layer is formed, the process will be quite similar to that described for the 0.5 per cent carbon composition, but again decarburization will be slower due to the availability of more carbon to replenish the decarburized regions.

At a temperature represented by point Y for the 1.0 per cent carbon alloy, the situation is somewhat different, at least initially. The first removal of carbon takes place from the cementite and will change the cementite to austenite. When only austenite remains on the surface, decarburization will lower its carbon content but it will not be until the carbon content strikes the curve GE at the surface of the steel that the first small quantities of ferrite will form. From this point on, the situation will not be dissimilar from that described for the 0.5 per cent alloy, but there will be a large difference in the rate at which decarburization proceeds since the carbon gradient is much larger in this instance and will supply carbon to the decarburized zone at a more rapid rate for at least a brief period at temperature.

Finally, for a composition represented by point Z, the circumstances are similar to those described for the composition at point C, except that it will be a longer period of time before the first amount of ferrite can be expected to form in this alloy, since it is necessary to remove an additional 0.5 per cent of carbon before the curve GE is reached, which will mark the first precipitation and formation of ferrite.

Metallographic Examination of Decarburization of Investment Castings. If we now examine a series of precision castings of several plain carbon steels, of hypo and hyper-eutectoid composition, as well as a number of low alloy steels, many of the conditons described above will be illustrated. Fig 2 shows the as-cast structure of a C 1040 steel at 75 X. Section (a) is from a larger section of the casting which is approximately ½ in.

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SAND SPECIFICATIONS — REPRESENTATIVE SCREEN ANALYSES

Unground Sand	4098	4085	4060	4040	4030	4020	5040	5030	5025
Ret on 20 Mesh	2.2								
Thru 20 ret on 30	38.6	12.4	5.6	0.6	0.4	0.4			
Thru 30 ret on 40	57.6	70.8	56.2	37.2	30.2	21.2	4.0	1.2	0.6
Thru 40 ret on 50	1.4	16.3	34.8	52.0	55.8	51.4	34.8	30.4	23.8
Thru 50 ret on 70	0.2	0.5	2.8	9.0	11.4	20.6	44.4	48.2	42.0
Thru 70 ret on 100			0.6	1.0	1.8	5.2	14.4	17.8	26.4
Thru 100 ret on 140				0.2	0.4	1.0	2.0	2.0	6.2
Thru 140 ret on 200						0.2	0.4	0.4	0.8
Thru 200 ret on 270									0.2
Grain Fineness (AFS)	25.88	30.49	33.72	37.48	38.82	42.22	49.96	51.64	56.90

Unground Sand	5015	5010	5005	7030	7020	7010	C-30	C-10
Ret on 20 Mesh								
Thru 20 ret on 30								
Thru 30 ret on 40	1.2	0.4	0.2	0.2	0.2			
Thru 40 ret on 50	15.2	11.2	4.4	3.0	2.4	0.4		
Thru 50 ret on 70	40.2	35.2	31.2	26.2	18.0	8.2	0.4	0.2
Thru 70 ret on 100	35.4	37.4	41.2	42.0	45.0	46.6	28.4	8.4
Thru 100 ret on 140	6.4	10.8	15.4	16.4	20.0	23.2	44.8	50.2
Thru 140 ret on 200	1.2	4.0	5.6	9.6	11.0	15.4	18.8	28.2
Thru 200 ret on 270	0.4	0.8	1.4	1.8	2.4	4.2	5.0	8.8
Thru 270 ret on 325		0.2	0.6	0.8	1.0	2.0	2.6	4.2
Grain Fineness (AFS)	60.20	66.92	73.92	79.36	84.42	95.44	108.22	124.60

Ground Sand (Flour)	80M	100M	140M	200M	300M	325M	400M
Ret on 60 Mesh	10/20%						
Thru 60 ret on 100	25/30%	5%					
Thru 100 ret on 140	15/20%	14%	4%	1%			
Thru 140 ret on 200	10/15%	16%	6%	4%	2%	Trace	
Thru 200 mesh	25/40%						
Thru 200 ret on 270		10%	12%	6%	2%	0.5%	Trace
Thru 270 ret on 325		12%	8%	9%	11%	4.5%	2%
Thru 325 mesh		43%	70%	80%	85%	95.0%	98%

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STANDARD CASTING SANDS — BLASTING SANDS
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CIRCLE NO. 151, PAGE 21-22

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"LITTLE JOE" provides these advantages:

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We call it

"LITTLE JOE"

To the best of our knowledge this is the first practical automatic ladling unit yet devised. It will fill an important need in many casting operations. For complete information, get in touch with your nearest Lindberg Field Representative (see your classified phone book) or write direct.

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CIRCLE NO. 152, PAGE 21-22

thick. Section (b) is from a thin portion of the same casting, which is about ⅛ in. thick. Two factors are immediately evident. In the heavier portion of the casting where solidification and cooling took place more slowly, the depth of decarburization is considerably greater, and the ferrite along grain boundaries is also heavier. The ferritic grain boundaries attest to the very much higher diffusion rate of carbon along grain boundaries, a well-known phenomenon.

Fig 3 shows the as-cast condition of a C 1095 steel in the as-cast condition. These sections are from a precision casting measuring ⅛ in. in thickness throughout the entire casting. View (a) shows the decarburization present in a small projection of metal of the surface and clearly shows that this area is almost entirely decarburized; yet because of the high carbon content the general depth of decarburization is relatively shallow even at 100 X. In examining the surface structure more carefully at 250 X, it will be noted that there is a small amount of decarburization which does not, however, produce a continuous decarburized layer at the surface. The photomicrographs shown in Figs 2 and 3 can be compared directly to the discussion of decarburization according to the phase diagram above.

Figs 4, 5, 6, and 7 present an interesting series of photomicrographs. Fig 4 shows the structure of a C 1080 steel which was cast into an 1800 F mold of large volume, with resultant very slow cooling. Fig 5 shows the same type of casting in the same composition, cast in an investment mold preheated only to 1600 F, and so constructed that the amount of investment material around the casting and exposed to the outside atmosphere was less than ¼ in. in the heaviest section. It is immediately obvious that the depth and the amount of decarburization in the slowly cooled casting illustrated in Fig 4 is very much greater than in the rapidly cooled casting shown in Fig 5. Of particular interest is the comparison first of the depth of decarburization, and secondly of the width of the ferrite at the grain boundaries.

It is probable that the casting

shown in Fig 5 might find use without further treatment, such as recarburization, whereas for certain uses the casting shown in Fig 4 would have to be recarburized for use. Figs 6 and 7 of these same castings, show the structure after each casting had been normalized at 1600 F for ½ hour. The depth of decarburization of the normalized structures has increased slightly but the difference between the two sets of castings is clearly evident.

Whereas in Fig 2 the rapidly cooled thin section of the casting showed less decarburization than the slowly cooled portion of the casting, in Figs 4 to 7, the rapidly cooled tapered tip of the casting, which was cooled more rapidly, shows greater decarburization. However, this is due to the vastly increased surface area of metal exposed to the decarburizing atmosphere.

Examination of a C 4140 steel showed that the presence of about 1 per cent of chromium was not adequate to change significantly the decarburizing tendency of relatively large (1⅝ in. diameter x 1 in. high) castings in the slow cooling of the investment mold.

In all instances where the castings had thin cross sections, 1/16 in. to ¼ in. and/or cooled rapidly, there was a notable reduction in decarburization. This is clearly demonstrated by the photomicrographs in Fig 8.

SUMMARY

1. For a given section size and cooling rate, the hypo-eutectoid steels are more severely decarburized than the hyper-eutectoid steels.

2. The thinner the cast section the less the extent of decarburization.

3. Rapid cooling, especially in the temperature range of about 2200 F, would be desirable but would have to be done carefully to avoid large variations in hardness from casting to casting and to avoid warpage and cracking of readily hardenable grades of steel.

4. Small amounts of Cr, Mn, Si, W, and Mo do not improve decarburization resistance measurably.

Condensed from the original paper by Dr. Grant presented at the 1956 annual meeting of the Investment Castings Institute in New York City.

SHOOTING CORES

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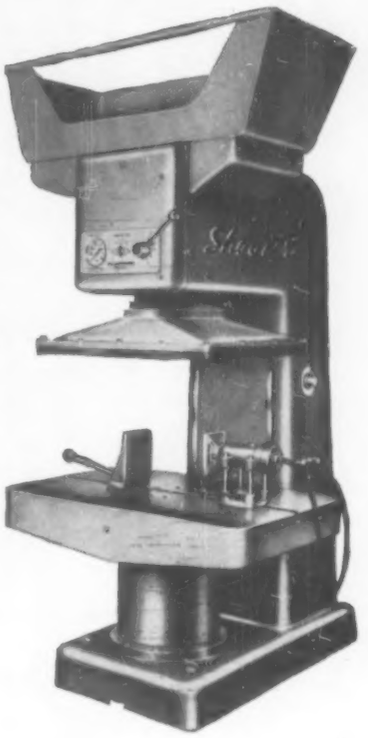
"DAVENPORT" HANSBERG SHOOTER

Hansberg Shooters can shoot intricate, precision cores in less time, at a lower cost per core, because the sand is pushed into the cavity by air instead of being carried in with air. The sand absorbs the pressure shock and no air leaves the shooter with the sand.



HANSBERG, THE ORIGINAL SHOOTER

There are no moving parts in the Shooter. Cores can be shot in wooden boxes without special attachments and without causing wear because there is no sand blasting action. Venting of boxes can be reduced to a minimum since the propelling air does not mix with the sand in the magazine. The only venting required is for the air in the box.

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The Hansberg Shooter has no side posts. It is open on three sides permitting conveyor operation. The height of the Shooter table is adjusted by finger-tip control due to the air-on-oil hydraulic feature, thus doing away with slow hand operated spindles and wheels. There are no spindles for the oil-pneumatic side clamps, and when not used they can be removed and put aside for further freedom of operation. These features increase production in any kind of a set-up.

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Most Hansberg Shooters are used for the regular production of oil or green sand cores. However, the fact that the air does not mix with the sand makes the machine ideal to handle sands bonded with sodium silicate for the CO2 process. More than 2,000 Hansberg Shooters are in use in the U.S.A. and Europe. They have been found to be practical also for making hollow shell-cores and shell-molds. Thus, the Hansberg Shooter is the most universal machine in the foundry, being adaptable for cores in any process.
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foundry trade news

Progressive Foundry Inc. . . . is new corporate name of Progressive Foundry Co., Perry, Iowa, which has been purchased and will be operated by the following foundrymen: Philip G. Smith, president; Harold W. Schroeder, vice-president and general manager; Jack Bean, vice-president, secretary, and treasurer.

Superior Brass and Aluminum Casting Co. . . Lansing, Mich., firm owned and operated by C. D. Coffman and M. B. Fiandt for the past 32 years has been sold and the previous operators have retired from business. New owners of the company are W. W. Edwards and C. C. Sigerfoos of Lansing.

Prenco Products Co. . . is a new company located at Clarkson, Ontario, which has been formed to manufacture foundry supplies and equipment. General manager John M. Atwood states that the firm will specialize in treating casting porosity. Firm will produce and sell Harmark line of supplies under license from Harborough Const. Co., Ltd., of England.

Mesta Machine Co. . . has purchased the government-owned foundry and machine shop at New Castle, Pa. Mesta was high bidder at public auction for this defense plant. Sale was made under the National Industrial Reserve Act and the plant and machinery cannot be sold or converted without consent of the Secretary of Defense.

Pennsylvania State University . . has started publication of a news letter

New minerals and refractory compounds that might be used by the metal castings industry are being studied in a research program now underway at the Foundry Facings Development Laboratory of Frederick B. Stevens, Inc., Detroit. Here are some casting sections made by Armour Research Foundation lab under direction of the Stevens labs.

for foundrymen in Pennsylvania. Copies of the letter may be secured from Wes Winter, Industrial Engineering Department, Pennsylvania State Univ., University Park, Pa.

Barker Foundry Supply Co. . . . Pasadena, Calif., sales and service firm has joined American Foundrymen's Society.

Alter Co. . . . secondary nickel alloy manufacturer has purchased the physical assets of the Davenport Besler Corp., Davenport, Iowa. Company will use plant for additional electric furnace facilities.

Cleveland Quarries Co. . . . 71-year-old sandstone producer is taking a leaf from the meat packers' book by utilizing a quarry byproduct. Sandstone formerly rejected as building refractory stone is now being crushed in a specially designed $150,000 crusher and is finding use in the metal castings industry. In pea gravel size it may be coated with clay and mixed with water and an additive and gunned on to patch cupolas. It is also in demand as hearthbottom stone and as firesand. Utilization of former waste material is expected to help increase firm's volume of business by 10 per cent in 1956.

Shalco Engineering Corp. . . . has consolidated with Shallway Corp. Consolidated company will include a new shell mold pattern supplies division with headquarters at the Shalco Demonstration Center, Connellsville, Pa.

Solar Aircraft Co. . . . has announced a 25 per cent expansion in space for its Des Moines, Iowa, plant.

Andrew Terry Co. . . . Terryville, Conn., malleable foundry has joined American Foundrymen's Society.

Molybdenum Corp. of America . . has announced its activity in mining, processing and selling ferrocolumbium, now available for commercial use since government stock-piling is complete.

Pittsburgh Metals Purifying Co. . . . has been sold to the Treesdale Laboratories and Textile Processing, Inc., Mars, Pa., and will be operated as a subsidiary.

Shenango-Penn Mold Co. . . . foundry operations of this subsidiary of Shenango Furnace Co. have been merged into the parent company. Merger af-

FOUNDRY CORE PRACTICE

Second Edition covers ingredients, mixing methods and preparation of cores as well as setting and holding them in molds!

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Core Finishing Operations
Core Coatings
Core Handling
Procedures for Determining the Properties of Cores and Core Mixtures
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fects foundries at Sharpsville and Neville Island, Pa., and centrifugal casting operations at Dover, Ohio.

Eastwood & Co. . . . Portland, Ore., sales and service organization has joined American Foundrymen's Society.

Alloy Precision Castings Co. . . began operations in new plant at 3855 W. 150th St., Cleveland, on August 15. Plant produces castings by both the frozen mercury process and the investment process.

Arrow Pattern & Eng. Co. . . . has moved its operations into a new building at 1806 Nagle Rd., Erie, Pa.

Magnesium sand casting shipments have continued to show the slight increase which has marked the current year according to the Magnesium Association. Shipments for May were up 13 per cent over the same month in 1955.

American Steel Foundries . . earned $5.50 per share during the first nine months of 1956.

Armour Research Foundation . . the Illinois Institute of Technology research organization has placed vacuum melting furnace in operation in their metals research labs. Furnace has capacity of 50 lb ferrous metal.

Interlake Iron Corp. . . . has acquired the assets of Globe Iron Co., Jackson, Ohio.

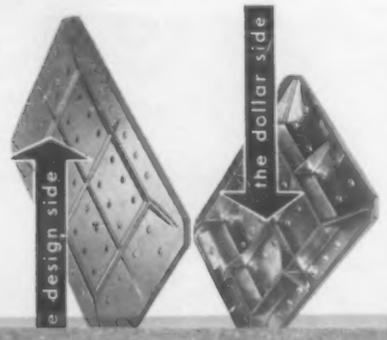
Whiting Corp. . . . Harvey, Ill., equipment manufacturer completed 72 years in business on April 30 with report showing earnings of $1.43 per share, an increase from $1.19 in 1955. Developments during last fiscal year included purchase of Volta Mfg. Co., Ltd., Welland, Ont.

Chicago Apparatus Co. . . . has established a service and repair policy for scientific instruments that is similar to TV set service policies.

Curtiss-Wright Corp. . . . Buffalo, N.Y., plant has joined American Foundrymen's Society.

Climax Molybdenum Co. . . . earned $2.53 per share during the first six months of 1956.

Vanadium Corp. of America . . celebrates its 50th anniversary with record sales. First half earnings for 1956 were $2.68 per share; 1955 earnings *Continued on page 81*



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foundry facts

Sand / Technological Principles

Properties of core sands is the concluding subject in this series condensed from the Sand Technology Short Course which has been presented before AFS chapters and regional conferences.

4. Organic Binders—Liquid. Liquid binders used for cores can be broadly divided into drying oils, oleoresinous, and resinous types.

Drying oils without modification are not used to any great extent. Incorporation of a resinous phase in a drying oil will provide much better core properties than the use of only drying oil.

Most widespread liquid binder in the foundry core field is the oleoresinous type. Combinations of various drying oils such as linseed, soya, tung, etc., with rosins and resins provide a large share of the core oil of commerce. The incorporation of these resins in the drying oil necessitates the use of petroleum thinners (kerosene) as checks on the viscosity of the finished product. Kerosene also serves to provide proper workability of the core oil in the sand.

Resin binders may be divided into the natural resins (called rosins) and the synthetic resins (phenol and urea formaldehyde). Phenol formaldehyde can be used as a solid resin for the shell and hollow core processes.

One of the reasons for the ease of baking of these synthetic binders is that the water which is used as the solvent for them can more easily be driven off during baking than can kerosene, the thinner in a core oil system.

Natural rosin by itself does not find great favor in the castings industry today. It is used in a modified form in oleoresinous binders.

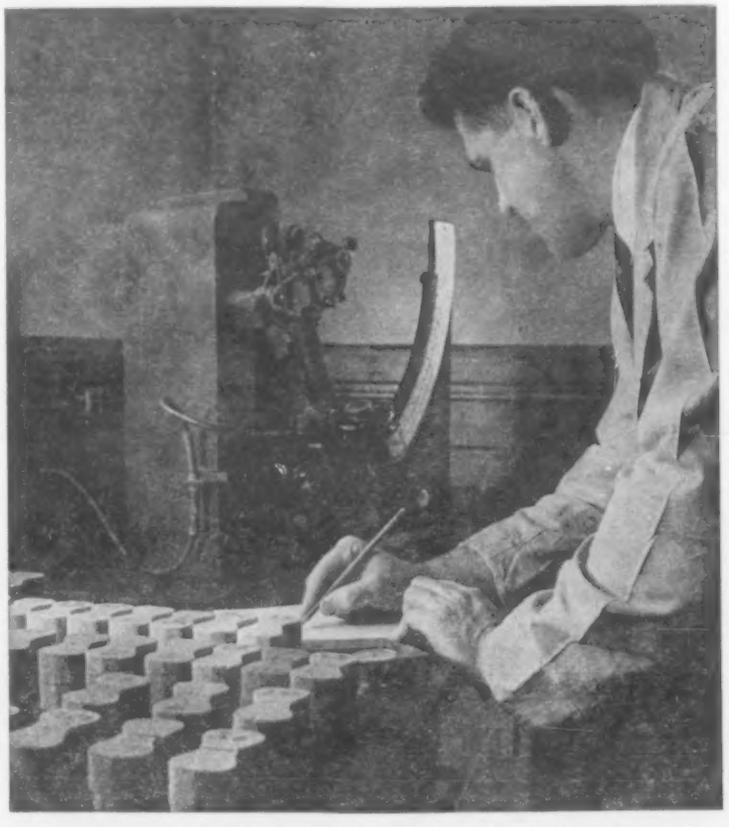
The normal core sand mixture contains both liquid and dry binders. The dry binder is principally used for green strength, while the liquid binder provides core handleability after baking.

5. Mixing of the binding ingredients is an important aspect of core sand practice. The first important point to consider is that the usual dry green bond additives, whether they are cereal or clay, need moisture for activation. It therefore behooves the foundryman to moisten the dry binder before it is waterproofed by liquid binder.

It does not make much difference if a cereal is put into a batch of wet sand or the cereal is first mixed with a dry base sand **so long as the cereal and water have an intimate contact before a core oil is added.** In the case of a liquid resin binder, the order of addition is not as critical since the resin binder solids are usually dispersed in water and not in a petroleum solvent. Since time is an important factor in the development of green bond, add cereal or clay at the earliest possible moment.

Excessive mixing time usually results in higher baked strengths as more and more of the dry binder is abraided and worked into solution. The green bond degrades as the baked bond increases up to that point where volatile matter is lost from the liquid binders, and the sand grains are actually reduced in size through abrasion. Theoretically, the green bond will rise through the addition of fines to the mass and the baked bond will decrease as more surface area to cover reduces the film thickness. Actually, the mixture usually dries out before this period is reached. The addition of more water makes the mixture once again workable, but inefficient.

If a dry base sand is purchased, it is best to add the calculated amount of water to the base sand, then add the dry binder, and finally the oil or resin.



Good practice is result of coupling common sense and rigid control.

6. Base Sand. Whether a foundryman uses a dry base sand or a moist crude sand depends upon many factors. For absolute core sand mixture control, a dry sand should be used. Crude wet sand usually contains higher moisture than is necessary or desirable in a core sand mixture. Control is lacking when sand is purchased wet. On the other hand, damp sand does not segregate in storage, and month to month sieve analysis of crude

sand from storage shows more uniform distribution than does dry sand drawn from the same bin.

If dry binders are added to a damp sand, there is less tendency for them to "dust out" during the preliminary mixing cycle, and this results in better control of the additive as well as better working conditions for the mixer operator.

Hot strength additives, inhibitors, and other special agents are used in many core sand mixtures. These ingredients should be treated as the dry binders are and should be added early in the mixture and as near as possible to the water addition.

When release agents are employed, they should be added at the very end of the cycle with the idea of putting an outside coating on the sand grains so that the release agent is in contact with the pattern surface during coremaking.

Humectants might best be added near the end of the cycle so that they can hold the moisture in the mixture.

% Amounts Of Binders

In general, a 50-60 mesh core sand mixture can be successfully evolved from a formulation using 1% cereal, 2.5% water and 1% core oil by weight. If the sand is finer, less cereal, more water and more oil are necessary. If the sand is coarser, then more cereal, the same amount of water and less oil are necessary. A cereal to water ratio of 1:2 gives excellent green bond. The more water used, the less the green bond, the higher the baked strength, and the longer the baking period necessary.

When synthetic resins are used, about 1/2% resin solids give a good core in combination with 1% cereal. Release agents are usually necessary.

When clays are employed for green bond, a general rule is that for every pound of clay used, an additional pint of oil should be added to maintain a standard green strength. If no appreciable amount of green bond is necessary, the cereal binder can be omitted and what little workability and green properties are necessary can be obtained by judicious water additions.

Addition of more and more water does not make a stronger core if core oil or resins are the sole baked bonding agents. Harder core surfaces are caused by binder migration, but the strongest core is obtained when no water is used and the sand grains have intimate contact. When cereal is present, additional water will make stronger as well as harder cores.

Properties of Core Sands

8. Green Core Properties. Before the sand mixture can be successfully molded, it must be tailored for the type of equipment in which it will be used. Hand ramming tolerates lower flowability and rammability than blowing. As core making machines improve, fewer and fewer restrictions are put on the core sand so that the mixture may be formulated with the casting, rather than the core making process in mind.

Special fabrication methods such as stock core machines require unusually "heavy" mixtures which are normally bonded with high percentages of dry binder together with more than the normal amount of oil for sand lubricity.

Stickiness is another important green physical property of a core sand mixture. In general, the higher the green bond of a core sand mixture, the less the stickiness. Excessive amounts of any and all binders promote stickiness as does excessive mulling with attendant hot sand. Resin binders are inherently more sticky probably because of the use of water rather than petroleum hydro-carbons as their dispersing agents. Usually the more water soluble a material is, the more sticky it is.

The third important factor to be considered is sagging resistance. This property has been measured in the past by green compressive strength, but modern methods make use of an impact tester which actually indicates the deformation of a core under repeated jolting. Liquid binders tend to reduce the impact strength or sag resistance of core sand mixtures, while dry binders improve it. Clays are more beneficial than cereal in this respect, since they produce a more brittle mixture which will not deform appreciably before breaking.

The amount of moisture in a green core sand mixture is vitally important because of the effect it has on all of the other physical properties; therefore strict moisture control and measurement is necessary.

9. Baked Core Properties. Among the most important baked properties of a core sand mixture are **hardness, baked strength, bakability, and density.** The first three factors represent handleability, and the latter, uniformity in ramming.

A core must have enough abrasion resistance and strength to be able to be placed in a mold without changing its contours. Too low a surface hardness, easily broken edges, and weak baked strengths result in core breakage while poor bakability means thermoplasticity on the plate side, and different densities lead to erratic casting finishes.

10. Elevated Temperature Properties. Ignition tests should be performed on baked cores to determine how much gas there is to vent. Foundry conditions can be approximated by using dip tests in the molten metal of the foundry.

Hot strengths, hot deformation data, and hot permeability readings are constantly being studied in the laboratory, and recent results demonstrate that it may be possible to correlate **molding sand data** with foundry practice. To date not much has been accomplished with core sand mixtures concerning their elevated temperature properties, since they tend to collapse in the dilatometer unless they are protected with an "own atmosphere" hood.

There has been some correlation between shakeout and hot strength that may prove of definite value to the foundrymen, but there is no standard procedure written yet for performing a hot strength test.

In conclusion, good core practice relies on common sense coupled with rigid control during every step of the process from testing the raw incoming sand to setting the core in the mold.

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Replacing sand transmission piping lines is quicker, easier with non-welded installations of WELD + ENDS with clamping screws. No threading, no special make-ready is necessary. Cut the pipe—slip the WELD+ENDS on—tighten the clamping screws . . . That's all there is to it.

Non-welded WELD + ENDS are better than flanges, especially where there is frequent replacing of pipe. They can be used over and over again with only the clamping screws requiring replacement.

Where pipeline vibration is severe, clamping screws may be equipped with Nylok lock nuts and Shakeproof washers as shown in the illustration.

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CIRCLE NO. 157, PAGE 21-22

Industrial tractors for small and medium-sized plants to do a big job.

Cast Muscles for New Tractors

■ Work Bulls with muscles of cast steel are a line of light and medium-duty utility tractors introduced by the new industrial division of Massey-Harris-Ferguson Inc. The new line of five tractors and attachments now going into production at the firm's Racine, Wis., plant depends on cast components to provide many of its features of strength and efficiency.

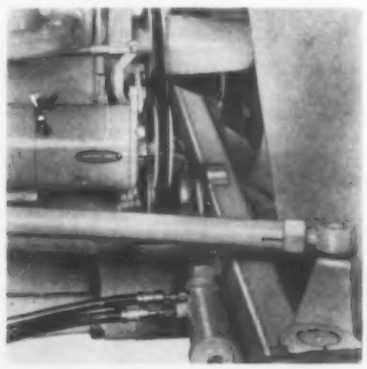
The line consists of a 34 hp, 42 hp, and 52 hp all-purpose tractors, a 42 hp fork lift tractor, and a 42 hp shovel-loader.

Mid-Western Industries, Wichita, Kansas, is supplying 20 Davis brand hydraulically controlled attachments for the tractors. These units provide tools for loading, lifting, dozing, materials handling and many other tasks.

The company considers that much of the success of these tractors depends on the cast steel axle of the small, 34 hp all-purpose tractor. Claimed to be the most widely applicable unit in the line, this tractor features a heavy-duty front axle and support that gives it a greater load-carrying capacity than any competitor. Other features of the equipment that are provided by castings include a cast oilpan which provides structural support for the engine and front end, a front motor support for strength and durability, and pintle hook or swinging drawbar.

Although all models did not go into production until September, the firm had orders for tractors worth $1.5 million in June. The orders include 397 units for the Corps of Engineers and 275 units for a private industrial concern.

Heavy-duty cast steel axle.



Cast oil pan supports engine.

Both sides of Edco Dowmetal Bottom Boards tell a story

Here are the structural and economic reasons why more and more foundrymen are using Edco Bottom Boards.

1. The flask side of an Edco Bottom Board is grooved and vented; permits gas-escape, insures mold stability.
2. The opposite side is braced like a bridge. The entire board is made of light-weight magnesium—gives you strength without weight for safe, easy handling and long board life.

That's the Edco Design Story. Here's the Dollar Story.

1. Edco Boards pay for themselves. One foundry switched to Edco and cut its yearly burning and breakage loss from 70% to 3%! A 5-year comparison check in another foundry showed that under identical conditions wooden boards had a "casualty" record of 7500 boards lost, as against a mere 12 for its Edco Boards. Scrap loss was 20% less.
2. Volume production of the most popular sizes makes your original investment your *only* investment. Edco Boards cost less than you'd expect.

Write for your free copy of the New Facts File. There's no obligation.

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EDCO DOWMETAL BOTTOM BOARDS
EDCO ALUMINUM CORE PLATES

Please send Facts File including list of 83 standard sizes available from stock.

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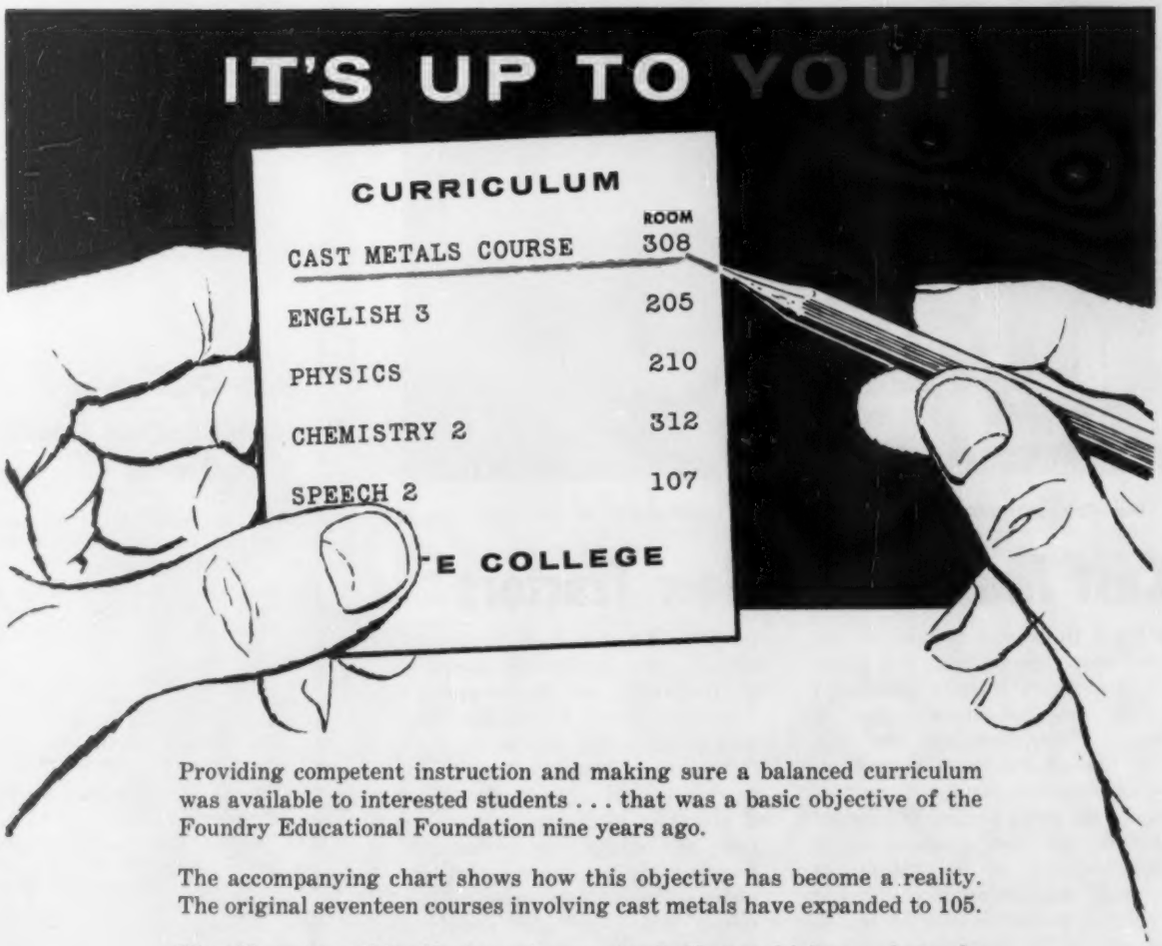
City-Zone-State_____

CIRCLE NO. 158, PAGE 21-22



Providing competent instruction and making sure a balanced curriculum was available to interested students . . . that was a basic objective of the Foundry Educational Foundation nine years ago.

The accompanying chart shows how this objective has become a reality. The original seventeen courses involving cast metals have expanded to 105.

We will continue this effort to raise our standards even higher . . . but only through **you** can this be accomplished. Your interest and encouragement and specific dollar support are needed. It's up to **you.**

FOUNDRY COURSES AVAILABLE

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To learn more about F.E.F. and its endeavors to help you to help the castings industry, write for our new booklet, "Let's Look Ahead".

You'll be glad you did.

Foundry Educational Foundation

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CIRCLE NO. 159, PAGE 21-22

FEMA Meets in October

Advance registrations indicate a record attendance at the 38th annual meeting of the Foundry Equipment Manufacturers Association to be held Oct. 18-20 at the Greenbrier Hotel, White Sulphur Springs, W. Va.

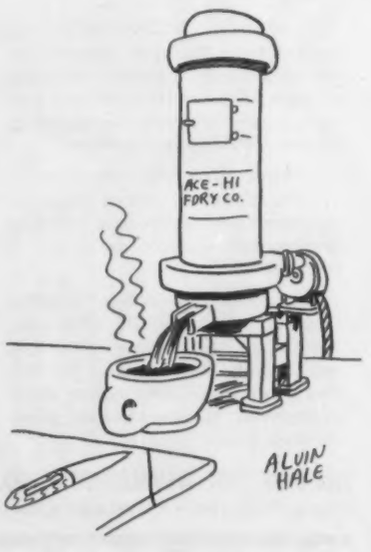
Opening day activities will center on discussions of basic foundry

W. Rex Jennings

equipment, including blast cleaning and tumbling, dust and fume control, flasks and accessories, furnaces and accessories, material handling and molding and core making machines.

Featured speaker will be W. Rex Jennings, foundry superintendent, John Deere Tractor Works, Waterloo, Iowa, whose topic will be "What the Foundry Industry Expects of Equipment Manufacturers."

A president, vice president, three directors, executive secretary and treasurer will be elected.



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Berlin Core Sand
Red Flint Annealing
New Jersey Molding
Gallia Red Molding
Albany Molding

BONDING CLAYS
*Volclay, MX-80 (Granular)
*and Panther Creek Bentonite
*Goose Lake Fire Clay
*Grundite Bonding Clay

ABRASIVES
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Mallan' Steel Shot and Grit
*Malleabrasive Shot and Grit
*Certified Shot and Grit
*Blackhawk Sand Blast Sand
*Super-Titan Nozzles

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CIRCLE NO. 160, PAGE 21-22

Mystery of the Chinese Pheasant

Can you identify the foundry mark on the accompanying photograph? Chances are you'll have to be an expert on foreign castings to do it—or maybe even a collector of artwork.

The foundry mark belongs to the handsome bronze Chinese pheasant whose photograph also accompanies this brief article. The pheasant is owned by Mrs. Louis Morrell of North Brunswick, N. J., who is trying to find out who cast it. Mrs. Morrell was referred to us by the New York Public Library. She says the name of the sculptor is very indistinct but looks like "GE SRTZI" or "GE SATTZI" or something of the sort.

Anybody an expert on European bronze castings?

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CIRCLE NO. 161, PAGE 21-22

local foundry news

Change of pace is this pitcher from Harry W. Dietert Co., Detroit. Seems to throw a nice curve. Her name is Jacqueline Gira and she obviously bats 1.000 because she got herself selected Miss Detroit Street Railways. When not looking pretty for pictures, Jacqueline is a secretary for the Harry W. Dietert firm.

BOB DE BROUX, MILWAUKEE CHAPLET & SUPPLY

A cheerful conference around the till was held by the committee for **Wisconsin** Chapter's golf outing. Conferees are, left to right, Brad Booth, Don Gerlinger, and E. Sadek.

The St. Louis Management Group of Gray Iron Founder's Society drew a sizable attendance for classroom instruction in foundry costs last spring (left photo) and will hold a second, advanced class this fall.

The windup of a meeting of the directors of the **Northeastern Ohio** Chapter at the Tudor Arms Hotel, Cleveland, found past chairman Lewis T. Crosby turning records and gavel over to his successor, the new chairman, Alex D. Barzcak.

New officers for **Northern California** Chapter are, left to right, Fred A. Mainzer, Harold Hirsch, Harold Henderson, president, and Davis Taylor.

Off to Chicago go Mr. and Mrs. Bruce Ball who won weekend trip at **Detroit** Chapter outing. E. A. Swensson presented the tickets for the chapter.

Continued from page 74

for the period were $1.86. Company also reported removal of its engineering facilities from Niagara Falls, N.Y., to Cambridge, Ohio.

Ohio Ferro-Alloys . . is building a barge dock on the Ohio river adjacent to its Brilliant, Ohio, plant. Barge shipments can now be made to foundries in Chicago, St. Louis, and other midwest locations.

Corning Glass Co. . . has joined Investment Casting Institute.

Hyster Co. . . has announced plans to open an assembly plant near Glasgow, Scotland. Another recent development moved R. M. Ervin into management of the company's Washington, D. C., office.

Solvent Service Inc. . . industrial equipment cleaning and descaling service has acquired the accounts of the Lemont Chemical Co., Lemont, Ill. Solvent Service has headquarters in Painesville, Ohio.

Wedgeplug Valve Co. . . affiliate of Stockholm Valves & Fittings will move from New Orleans to 4000 10th Ave. N., Birmingham 2, Ala.

Arwood Precision Casting Corp. . . will now do finish-machining of ferrous and non-ferrous castings at all its plants at Brooklyn, N.Y., Groton, Conn., Tilton, N.H., and Los Angeles, Calif.

National Malleable and Steel Castings Co. . . earned $3.82 per share during the first six months of 1956 which compares with earnings of $1.95 during the same period in 1955.

Rockwell Mfg. Co. . . will operate a 180,000 sq ft valve manufacturing plant at Kearney, Nebraska.

Archer-Daniels-Midland Co. . . earned $3.60 per share for its fiscal year ending June 30 which compares with earnings of $3.49 in 1955.

Battelle Memorial Institute . . has been licensed by the AEC to operate a research reactor. The reactor will be constructed for Battelle by American Machine and Foundry Co.

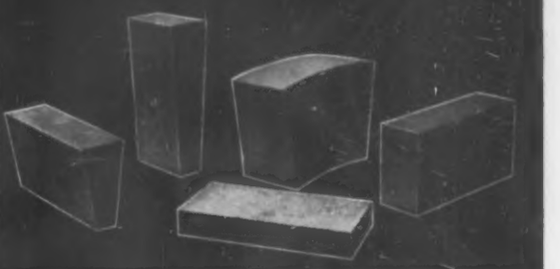
Colorado Fuel and Iron Corp. . . has moved its Philadelphia district warehouse and sales office to 225 West Erie Ave.

Conco Eng. Works . . has appointed Burgess Sales Co., as New York distributor for its cranes and hoists.

HELSPOT

PLASTIC For Repairs

BRICK For Linings

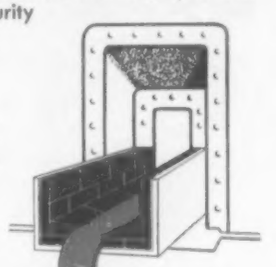


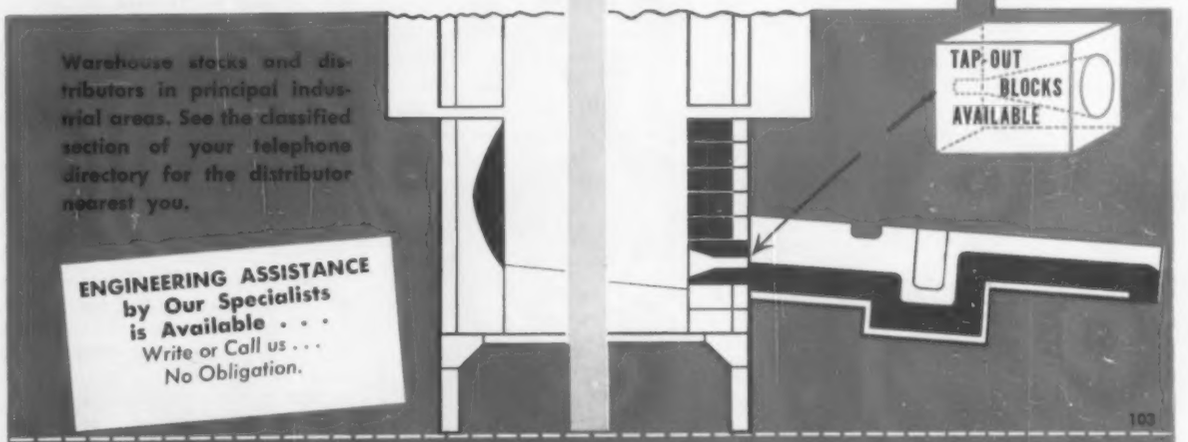
For fast, safe and economical repairing of the fire clay lining in the cupola-well, HELSPOT plastic may be easily installed over the spalled and eroded surface; simply ram HELSPOT in the "dished-out" area. It is easy to handle and install. Its "lubricating" qualities minimize the formation of slag and promote free flowing of the metal. Test HELSPOT by using it on your next repair job . . . let it prove its performance.
HELSPOT plastic is packed in 100-lb. waterproof cartons. It is conveniently sliced for ease of handling.

For quick repairs of ladle-linings, runners and spouts, rely on HELSPOT plastic.

HELSPOT brick, with a graphite base and high refractoriness are ideal for lining the cupola-well below the tuyeres. In many installations they are credited with giving many times the life obtained from brick and clay combinations. Maintenance problems are reduced, doors drop more freely; a marked saving in labor drudgery is noted. Production is increased, operation is more economical and purity of metal is increased.

HELSPOT BRICK are available in standard 9-inch series shapes and 9x6x4 cupola block sizes.





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CIRCLE NO. 162, PAGE 21-22

These Are the Metal Abrasives That Made Blast-Cleaning History

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Sold and Recommended by PANGBORN CORPORATION Hagerstown, Md.

Since 1886 Pittsburgh Crushed Steel Company has led the metal abrasives industry in product research and improved manufacturing methods to produce better metal abrasives for blast-cleaning.

SAMSON SHOT AND ANGULAR GRIT are the original chilled iron metal abrasives that led in the conversion from sand to metal abrasives for blast-cleaning at the turn of the century — accepted today as the best of their kind.

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TRU-STEEL SHOT is the original super-tough, heat-treated and drawn steel shot of tool steel quality — since 1948 the pace setter in production of the all-steel type of shot.

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Globe Steel Abrasive Co., Mansfield, Ohio
Steel Shot Producers, Butler, Pa.

CIRCLE NO. 163, PAGE 21-22

for the asking

Materials handling and power transmitting machinery catalog, No. 2653, 44 pages, covers research facilities, standard products and engineered equipment, major industries served, technical literature and other subjects. *Link-Belt Company.*

CIRCLE NO. 61, PAGE 21-22

Nickel alloy booklet, 16-pages, contains information on wrought and cast high-nickel alloys used at low temperatures. Data cover only materials in current use. *The International Nickel Company.*

CIRCLE NO. 62, PAGE 21-22

Spectroscopic electrodes and powders are listed in 16-page catalog A-4004. Actual size photos and dimensioned drawings show types of preformed electrodes. Each has a brief discussion. *National Carbon Company.*

CIRCLE NO. 63, PAGE 21-22

High refractory core and mold coatings, core oils and other sand conditioners are discussed in Bulletin 56-2, six pages in color with photographs and charts. *Thiem Products, Inc.*

CIRCLE NO. 64, PAGE 21-22

High-temperatures alloy, R-235, is discussed in booklet F30052, 12 pages describing the wrought, nickel-base, aluminum- and titanium-bearing precipitation-hardening alloy which is produced by vacuum melting. *Haynes Stellite Company, Div of Union Carbide and Carbon Corp.*

CIRCLE NO. 65, PAGE 21-22

Control valves, air and hydraulic, are described in six-page bulletin No. 561. Features are patented spaced design and shock resistant solenoid mounting. Rated at 600 cpm at pressure from 40 to 150 psi on continuous operation. *C. B. Hunt & Son, Inc.*

CIRCLE NO. 66, PAGE 21-22

Dihedral couplings, standard, mill motor and floating shaft are covered in eight-page catalog No. 62. Complete working data given on sizes, capacities and dimensions of Series D-100 couplings. *Ajax Flexible Coupling Co.*

CIRCLE NO. 67, PAGE 21-22

Fork lift truck operator's manual covers basic specifications, construction, operating instructions, safety tips and proper handling techniques. *Towmotor Corporation.*

CIRCLE NO. 68, PAGE 21-22

Melting furnace accessories catalog No. 601 contains eight-colored pages with pictures, diagrams, ratings and dimensions. *Lindberg-Fisher Div Lindberg Engineering Co.*

CIRCLE NO. 69, PAGE 21-22

Foundry coke, "Empire" brand is covered in four-page, colored-folder. Pictures show plant and various operations. *DeBardeleben Coal Corporation.*

CIRCLE NO. 70, PAGE 21-22

Slinger operation, specifications applications and adaptations are covered in

Bulletin 320. Brochure has more than 100 photographs. *Beardsley & Piper Div Pettibone Mulliken Corp.*

CIRCLE NO. 71, PAGE 21-22

Appliance grinding and polishing with abrasives is covered in 10-page booklet. It covers cases on pre-finishing, weld grinding and blending, remov-

ing imperfections and polishing and finishing. *Minnesota Mining and Manufacturing Co.*

CIRCLE NO. 72, PAGE 21-22

Overhead materials handling system is contained in booklet 2008-M. Included are principal components, formulas and figures for comparing various track sections. *Cleveland Tramrail Div The Cleveland Crane & Engineering Co.*

CIRCLE NO. 73, PAGE 21-22

Flangeway crossing guard, the Guardmaster, is described in four-page folder. It is designed for smooth crossings on rail installations on concrete, asphalt or crossing planks. *Kasle Steel Corporation.*

CIRCLE NO. 74, PAGE 21-22

Pallet-type steel boxes which set up or fold flat in less than 20 sec are the subject of eight-page booklet No. 1275-A which contains pictures of set up and manufacture. *Hamlin Metal Products Co.*

CIRCLE NO. 75, PAGE 21-22

Grinding wheel folder "Your Key to Better Abrasives" features pictures of testing operations for production control. *Keystone Abrasive Wheel Co.*

CIRCLE NO. 76, PAGE 21-22

Radiation pyrometer paper reprint of eight pages was delivered at A.I.E.E. general meeting. Two new pyrometers are covered. *Servo Corporation of America.*

CIRCLE NO. 77, PAGE 21-22

Elastic modulus characteristics of Meehanite metal are contained in a four-page summary of transverse tests. The study involved two types of this metal. *Greenlee Foundry Company.*

CIRCLE NO. 78, PAGE 21-22

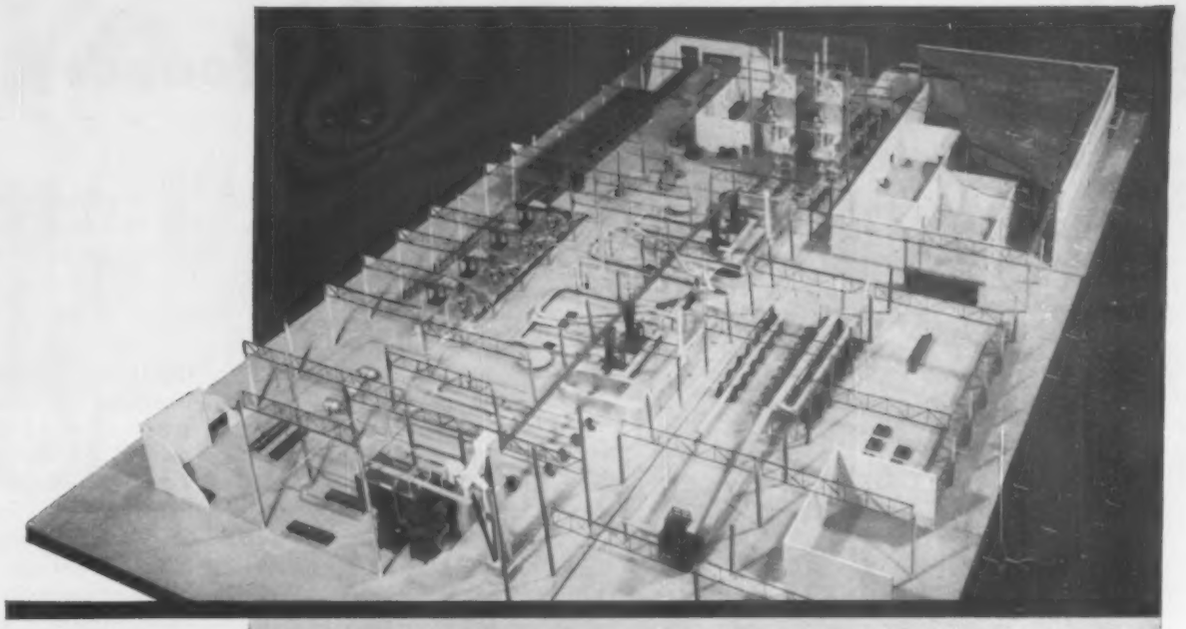
Vacuum equipment such as cleaners, separators, dumps and shakers are carried in Bulletin 155B. It is well illustrated with charts, diagrams and specifications. *The Spencer Turbine Company.*

CIRCLE NO. 79, PAGE 21-22

Non-metallic pipe, Koroseal, its properties, installations, applications and specifications are reviewed in an eight-page bulletin No. 10050. One page is devoted to chemicals commonly handled. *B. F. Goodrich.*

CIRCLE NO. 80, PAGE 21-22

Induction heating equipment is covered in 50-page booklet. Covers brazing and soldering applications, induction hardening, hot forming,



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AUTOMATION, SEMI-AUTOMATION, MECHANIZATION are a "must"

for profitable operation today of the Production and Production Jobbing Foundry

This model is a proposed modernization of an existing brass foundry. Operations are automated, semi-automated, and mechanized to a high degree to insure maximum productivity per man hour, with total production up to 12,000 tons of castings per year with a balanced 2-shift operation.

A reduction of approximately 55% is anticipated in man hours per ton of good castings, from new materials to finished castings ready for the machine shop. Working conditions are to be improved and more efficient controls of melting, sand, pouring, cores, and other variables should permit high quality castings with a minimum of scrap.

This program resulted from a survey of Knight Engineers with client personnel to determine, for this problem, the most modern technological improvements and new materials, methods, and controls that could be economically justified. Knight Engineers have made hundreds of surveys in all types, classes, and sizes of foundries to assist their clients to reduce costs, improve quality, working conditions, and financial return to workers, management, and owners.

Write for Knight Bulletin No 101, "Professional Foundry Engineering."

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CIRCLE NO. 179, PAGE 21-22

shrink fitting and other uses. Illustrated with photos, charts, drawings and cutaways. *Induction Heating Corporation.*

CIRCLE NO. 81, PAGE 21-22

Automatic control "Fireye," programs operating sequence of fully automatic rotary register oil and gas burners described in Bulletin CP-32, 11 pages. *Combustion Control Div., Electronics Corp. of America.*

CIRCLE NO. 82, PAGE 21-22

Flexible coupling selection chart, No. CM 41-45, 17 by 22 in. may be hung from wall. Horizontal headings include three coupling types with bore diameter range and vertical headings are for N.E.M.A. frame numbers and shaft sizes. *Morse Chain Company.*

CIRCLE NO. 83, PAGE 21-22

Heat exchanger with self-contained system is presented in Bulletin 132, four pages with illustrations and product photos. The problem of water supply and disposal is claimed to have been alleviated. *Niagara Blower Co.*

CIRCLE NO. 84, PAGE 21-22

Flurocarbon products, from plastic resins to acids and dielelectric fluids are covered in eight-page brochure which details types and grades available and suggested uses. *The M. W. Kellogg Company.*

CIRCLE NO. 85, PAGE 21-22

Diesel powered crawler tractor, the HD-11, featured in 16-page two-color catalog (MS-1100). Also included are specifications and two-page spread on line of optional equipment. *Allis-Chalmers Manufacturing Company.*

CIRCLE NO. 86, PAGE 21-22

Bendable tubing for electric conduit, air handling and protective coverings is explained in bulletin 61, three-pages of pictures, descriptions and specifications. Size range from ⅜ to 2 in. i.d. *The Flexaust Company.*

CIRCLE NO. 87, PAGE 21-22

Resin binder, Duo Resin, designed for dry sand molds and cores is described in four-page folder. It has baking range from 400 to 700 F and is said to set faster than pitch. *Whitehead Brothers Company.*

CIRCLE NO. 88, PAGE 21-22

Industrial chemicals featuring the entire line are contained in 20-page booklet AD-742-456 which lists char-

CIRCLE NO. 164, PAGE 21-22

A New Foundry Service by . . .

- COAT YOUR OWN SAND
- NOT A PILOT PLANT
- USE SAND TESTED IN PRODUCTION
- CAPACITY FOR 800—1200 lbs. COATED SAND PER HOUR
- YOU DETERMINE TEST CONDITIONS
- USE RESIN OF YOUR CHOICE
- WRITE FOR ARRANGEMENTS

Would you be willing to devote one half day of your time if that time could be spent in supervising controlled, production scale tests on resin coating your sand? Many Foundrymen have profited handsomely from experience gained in working with the National SHELL-MULL.

That's why the services of this simple, practical and standardized equipment are now being offered at no charge to anyone interested in increased hourly production and positive control over coated sand. The unit on the opposite page is part of National's New SHELL-MULL Performance Laboratory. It's not a Pilot Plant. The equipment is capable of producing 800 to 1200 lbs. of uniformly controlled, coated sand per hour. We can't bring it to you—but arrangements for production size tests made with your own sand, a resin of *your* choice and under *your* supervision, are now being accepted.

Results of these tests can be invaluable to you towards the more efficient production of coated sands. They will prove too, under conditions set by you, that the National SHELL-MULL will provide high production of better and more uniformly coated sand at lower operating costs (including resin usage) than any equipment offered for similar use.

Write today for details.

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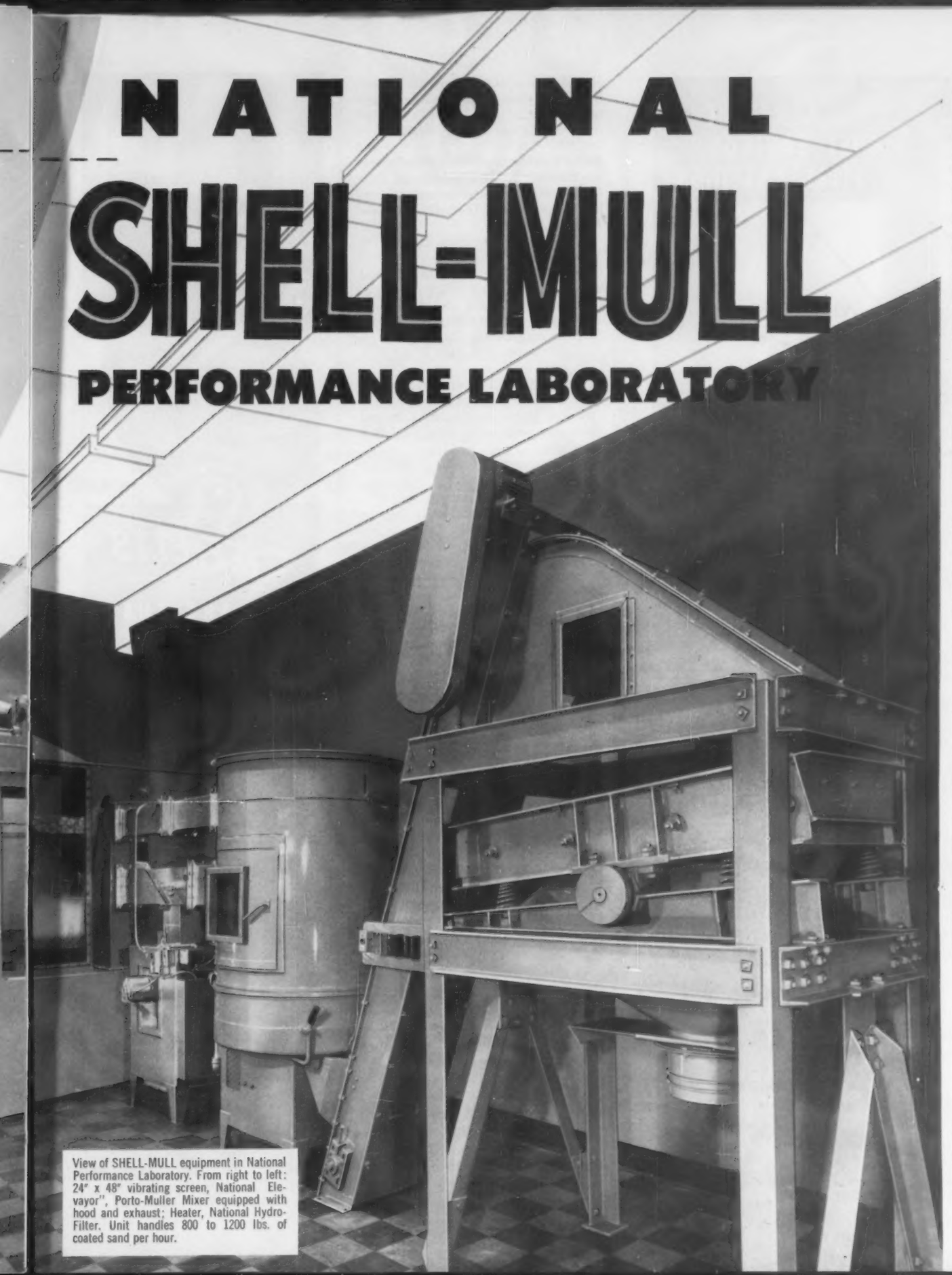
NATIONAL SHELL-MULL PERFORMANCE LABORATORY



View of SHELL-MULL equipment in National Performance Laboratory. From right to left: 24" x 48" vibrating screen, National Elevayor", Porto-Muller Mixer equipped with hood and exhaust; Heater, National Hydro-Filter. Unit handles 800 to 1200 lbs. of coated sand per hour.

acteristics, grades, containers. **Organic,** inorganic and specialty products are outlined. *Olin Mathieson Chemical Corporation.*

CIRCLE NO. 89, PAGE 21-22

Welding helmets made of plastic-impregnated glass fiber comprise the "S" line and catalogued in Bulletin 0303-4, colored-pages. *Mine Safety Appliances Co.*

CIRCLE NO. 90, PAGE 21-22

Mobile crane, model KE, which can handle up to 10,000 lb is described in four-page bulletin 1450, features pictures and cutaways. *Hyster Co.*

CIRCLE NO. 91, PAGE 21-22

Underhung bridge crane, assembled from kit, catalog 64, supports to 2000 lb and spans up to 25 ft. May be used with chain block or electric hoist. *Shaw-Box Crane & Hoist Div. of Manning, Maxwell & Moore, Inc.*

CIRCLE NO. 92, PAGE 21-22

Nickel alloy case history booklet, "Cast to Outlast" consists of 16 pages which include properties, alloys available, range of forms, specification data and notes on joining and machining. *The International Nickel Co.*

CIRCLE NO. 93, PAGE 21-22

American standards, how they are nationally accepted and approved is described in a 19-page booklet. *American Standards Association.*

CIRCLE NO. 94, PAGE 21-22

Sander and grinder catalog, No. 56-1, contains complete line of disc sanders and grinders. Illustrated in two-colors with specifications and photos. *Max Manufacturing Co.*

CIRCLE NO. 95, PAGE 21-22

Three new lift trucks and crane, pneumatic tired, are covered in catalog No. 1487, 11-pages. Other numbers in line are featured with capacities from 1000 to 30,000 lb. *Hyster Company.*

CIRCLE NO. 96, PAGE 21-22

Vacuum conveying equipment for handling bulk material is covered in Bulletin 55. Vacu-Veyor conveys up to 40,000 lb per hr and 150 feet vertically and 200 feet horizontally. *Vacu-Blast Co., Inc.*

CIRCLE NO. 97, PAGE 21-22

Diesel powered tractor HD-6G is covered in two-color, eight-page catalog MS-1101. Included are specifications and listing of interchangeable

CIRCLE NO. 164, PAGE 21-22

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cuts abrasive costs
up to 23%
for Crucible Steel Castings Co.

Wheelabrator Steel Shot proved most economical cleaning steel castings at Crucible Steel Castings Co.! Tests made in a 3-wheel Wheelabrator Monorail Cabinet showed these results: In 322 hours, the 3 wheels consumed over 19,000 lbs. of malleable abrasive, for an abrasive cost averaging $1.578 per wheel hour for each wheel. In 202 hours, the machine used approximately 6,800 lbs. of Wheelabrator Steel Shot for an average abrasive cost of $1.215 per hour for each wheel. This means savings of $.363 per hour for each wheel. The Milwaukee steel foundry operates 10 wheels a total of 100 hours each day, so daily abrasive cost savings add up to approximately $36.30 — or about $8,000 annually. You, too, can save with Wheelabrator Steel Shot, the low-cost answer to cleaning problems.

For additional information on Wheelabrator Steel Shot, send today for Bulletin 89-C.

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630 S. Byrkit Street, Mishawaka, Indiana
CIRCLE NO. 165, PAGE 21-22

matched attachments and the shovel hydraulic system. *Allis-Chalmers Manufacturing Co.*
CIRCLE NO. 98, PAGE 21-22

Barrel finishing methods and materials are covered in "Precision Barrel Finishing". Six pages also include deburring, descaling and burnishing. *Oakite Products, Inc.*
CIRCLE NO. 99, PAGE 21-22

Oxy-acetylene welding and cutting equipment including safety devices is contained in Catalog 150, revised in 1956. The complete line is covered. *Modern Engineering Co.*
CIRCLE NO. 100, PAGE 21-22

Heavy duty mill bearings are featured in Book 2665. Eight-pages include the complete line from 2 7/16 to 11 in. and dimension and rating data. *Link-Belt Company.*
CIRCLE NO. 101, PAGE 21-22

More Than One Answer

High phosphorous and high temperatures have always been the foundryman's answer to a fluid cast iron, but recent research has shown that similar fluidity can be attained chemically by close control of the total carbons and the silicon content. The findings were reported recently by E. R. Evans of the British Cast Iron Research Association.

High phosphorous does allow the running of thinner section, but only because it reduces the freezing temperature of the iron. Increasing the silicon or carbon content in a low phosphorous iron will result in a similar free running metal because they also lower the freezing temperature. Other elements such as manganese, sulphur, chromium, copper, and nickel have little effect on fluidity.

Oxidized metal caused by bridging, over-blowing, or low coke beds has often been blamed for misruns due to increased fluidity, but experiments prove that these effects merely cause lower pouring temperatures which is responsible for the scrap.

Good gating is of major importance in the preventing of misruns, but when they do occur in a proven mold, check your chemistry and temperature of the iron. JZ.

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MAKE THE DIFFERENCE

STEELETTS IMPROVE APPEARANCE, CUT COSTS IN NON-FERROUS FINISHING FOR THESE REASONS:

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Steeletts are a high-carbon electric furnace steel grit, especially-heat treated to remain full size far longer.

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WHEELABRATOR
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CIRCLE NO. 165, PAGE 21-22

patent review

MELVIN NORD
Patent Attorney

One-Piece Shell Molds

U. S. 2,736,077, issued February 28, 1956 to Kenneth M. Bartlett and assigned to Thompson Products, Inc., describes process for making one-piece shell molds with no parting lines.

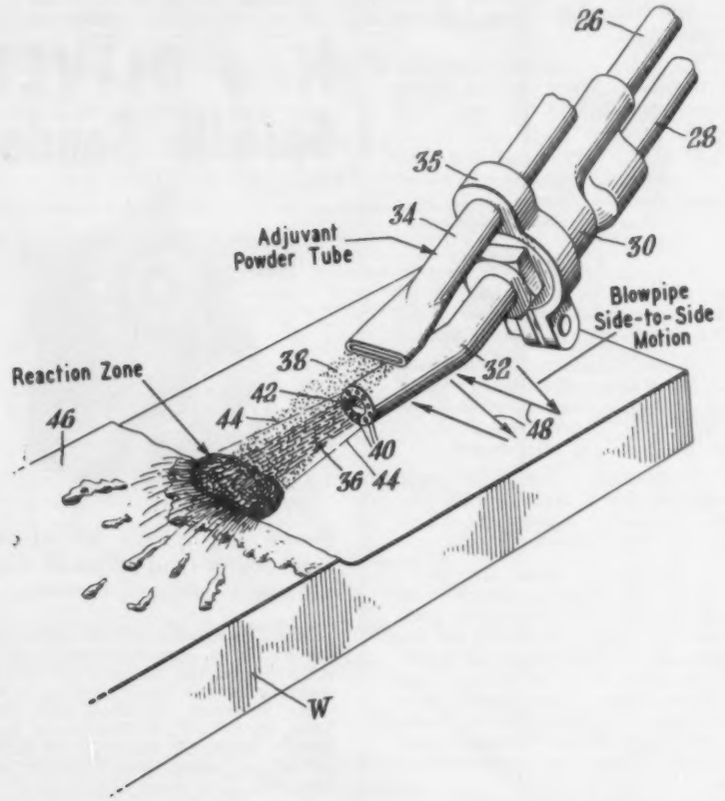
A pattern of the article to be reproduced is first made from a mixture of sodium and potassium nitrite. The pattern is then coated with a dry mixture of sand and thermosetting resin binder and heated to a temperature sufficient to cause setting of the resin binder. The pattern is then dissolved out of the set coating with water.

Alternatively, the pattern may be made of an alloy having a melting point between the bonding temperature and the setting temperature of the binder, e.g. a lead-tin alloy. Thus, as the coated pattern is heated to cure the resin, the pattern melts out, leaving a one-piece cured shell.

Washing Ferrous Castings

U. S. 2,735,796, issued February 21, 1956 to Dewitt T. Kelley, Roger S. Babcock and Edward M. Holub, assigned to Union Carbide & Carbon Corp., provides a method for the thermochemical cleaning of ferrous metal castings which not only removes sand trapped or cast in the surfaces but also removes metal projections or imperfections from the castings.

Drawing below shows method. The process consists of applying at an acute angle against the surface to be washed a round, gouging-velocity stream 36 of oxygen which is surrounded by flames 44 extending in the same direction as the oxygen stream, simultaneously applying against the surface at a greater angle a flat stream of air-borne iron powder, and swinging the blowpipe head 30 from side to side and forward. The resulting thermochemical reaction with the material of the work, W, cleans the surface by removing incrustations and other foreign matter from it.



Air-borne iron powder burns in oxygen stream to wash castings clean.

Sand Condition

U. S. 2,735,662, issued February 21, 1956 to Algot A. Wickland, provides apparatus for blending sand for molding purposes with a film of moist clay or bond in a manner which simulates the results obtained by hand shoveling.

Three paddle mixers are assembled one above the other, with provision for convenient and ready access to all moving parts for cleaning, repair, or replacement. This is accomplished by providing removable mixing paddles and a hinged panel extending the full length of the housing for inspection and cleaning and for the replacement of worn-out paddles.

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(above) Car type mold drying oven installed at Centre Foundry, Wheeling, West Virginia.

(left) Rack type Recirculating Gas-Oil Fired Core Ovens at Golden Foundry, Columbus, Indiana.

Write for Bulletin 53-CM

THE carl mayer CORP
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CIRCLE NO. 166, PAGE 21-22

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CIRCLE NO. 174, PAGE 21-22

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VIBRON BANTAM RAMMER IS . . .

The Smallest pneumatic rammer available with a POWERFUL SHORT HI-FREQUENCY STROKE
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CIRCLE NO. 175, PAGE 21-22

afs chapter meetings

OCTOBER

1 . . Metropolitan . . *Essex House Hotel, Newark, N.J. Ralph L. Lee, Lee Hobby Foundry, Birmingham, Mich., and appearing under the auspices of General Motors Corp., will speak.*

1 . . Central Indiana . . *Turners Anthenaeum, Indianapolis. Garnet P. Phillips, general supervisor, foundry research, International Harvester Co., Chicago, "Water Cooled Cupola Operation."*

2 . . Rochester . . *Hotel Seneca, Rochester. M. J. Kellner, foundry superintendent, Westinghouse Electric Corp., Trafford, Pa., "A Practical Approach to a Profitable Foundry."*

3 . . Toledo . . *Heather Downs Country Club, Toledo. William J. White, eastern district sales manager, Shalco Engineering Corp., "Shell Molding."*

5 . . Corn Belt . . *Rome Hotel, Omaha, Neb. William J. White, eastern district sales manager, Shalco Eng. Corp., "Shell Molding and Shell Cores."*

5 . . Mo-Kan . . *Fairfax Airport, Kansas City, Kan. D. L. LaVelle, Kaiser Aluminum Co., "Major Aluminum Problems and Their Solutions."*

8 . . Timberline . . *Oxford Hotel, Denver. William J. White, eastern district sales manager, Shalco Eng. Corp., "Shell Molding."*

8 . . Michiana . . *Whitcomb Hotel, St. Joseph, Mich. Ray Olson, vice-president, Southern Precision Pattern Works, Inc., "Shell Molding and Shell Molding Pattern Equipment."*

11 . . Northeastern Ohio . . *Tudor Arms Hotel, Cleveland. Wm. Hambley, service engineer and foundry consultant, Chas. A. Krause Milling Co., "Casting Defects."*

12 . . Eastern Canada . . *Sheraton Mount Royal Hotel, Montreal. Herbert J. Weber, director safety, hygiene and air pollution control, AFS, "A Word of Things to Come in Safety and Air Pollution."*

12 . . Mid-South . . *Claridge Hotel, Memphis. George E. Miller, San Blo Div., Federal Foundry Supply Co., "Core Blowing & Mold Blowing."*

12 . . Ontario . . *Royal York Hotel, Toronto. Group meetings: Gray Iron, R. Schneidewind, Prof. of Met. Eng., Univ. of Mich., "Injection Carburizing and Desulphurizing of Gray Iron;" Malleable, A. H. Karpicke, Chief Metallurgist, Saginaw Malleable Iron Plant, General Motors Corp., Saginaw, Mich., "Pearlitic Malleable;" Non-ferrous, Dr. Weingard, Univ. of Toronto, "Nucleation of Bronze Castings."*

12 . . Tri-State . . *Wilder's Restaurant, Joplin, Missouri. Clifford E. Wenninger,*

After more than 500,000 tons

"The Ringlift has helped us more than any other piece of equipment we have ever purchased," says General Manager of this leading Midwestern gray iron jobbing foundry.

This very hot, hard, lumpy sand is prepared, tempered and cooled by the Ringlift without prior addition of water. The sand is mixed, screened, magnetically cleaned, thoroughly aerated and cooled.

This foundry also uses the Ringlift daily to prepare several tons of thoroughly aerated facing sand.

Larger windrows than that above, even large piles, can be handled easily with the Ringlift. Hidden castings in the sand cannot damage it. No shearpins to replace.

You, too, can benefit by preparing your sand properly, right on the floor where it will be used. Investigate Ringlift today.

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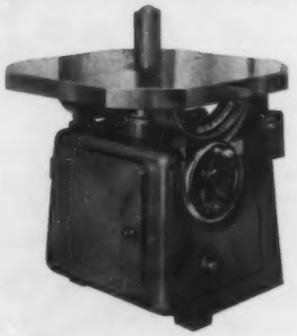
CIRCLE NO. 172, PAGE 21-22

New OLIVER Spindle Sander



Heavy duty Spindle rotates and oscillates to sand edges of scroll work on patterns

This sander smooths difficult work easily and accurately. Its 1-inch spindle rotates at 1800 r.p.m. and oscillates 1¼" with 56 strokes a minute. Spindle tilts up to 45° toward operator, 5° away from him. Takes drum 2", 4", 6" diameter, 9" long. Spindle adjustable vertically to permit full use of sanding area. Write for Bulletin 381.

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GRAND RAPIDS 2, MICH.
CIRCLE NO. 173, PAGE 21-22

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CIRCLE NO. 168, PAGE 21-22

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Modern industry, built upon mass-production methods, has constantly searched for a system of quality control which is rapid, economical, and capable of maintaining certain standards of quality. The *purpose* of quality control is to aid in IMPROVING QUALITY, LOWERING COSTS, and MAKING SUPERVISION EASIER.

Chapter headings include:

- Sand Control Applications
- Melting Practice
- Quality Control Applications in the Coreroom
- Applications in Molding Practice
- Pouring Practice
- Installing the Quality Control System & Training Personnel
- Calculations Involved in Quality Control
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128 pp. *66 figures* *15 tables*

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Mail to: Book Dept., American Foundrymen's Society, Golf & Wolf Roads, Des Plaines, Ill.

Hydro-Blast Corp., Franklin Park, Ill., "Digging Into Sand Fundamentals."

12 . . Philadelphia . . *Engineers Club, Philadelphia. William B. Coleman Lecture, Ralph L. Lee, Lee Hobby Foundry, Birmingham, Mich., and appearing under the auspices of General Motors Corp., "Leadership And What It Takes."*

17 . . Central Michigan . . *Hart Hotel, Battle Creek, Mich. Wm. A. Hambley, service engineer and foundry consultant, Chas. A. Krause Milling Co., "Scrap—Whose Responsibility?"*

19 . . Birmingham . . *Tutwiler Hotel. C. E. Wenninger, technical director, Hydro Blast Corp., "Digging Into Sand Fundamentals."*

19-20 . . New England and Connecticut . . *Massachusetts Institute of Technology, Cambridge, Mass. New England Regional Foundry Conference.*

25-26 . . Central Indiana, Michiana, Purdue . . *Purdue University, Lafayette, Ind. Purdue Metal Casting Conference.*

26 . . Chesapeake . . *Engineers Club, Baltimore, Md. M. C. McFadden, Jr., International Nickel Co. "Ductile Iron, Melting and Machining Properties."*

NOVEMBER

7 . . Toledo . . *Heather Downs Country Club, Toledo. C. A. Sanders, vice-president, American Colloid Co., Chicago, "Casting Finish, Tolerance and Precision of Sand Castings."*

8 . . Northeastern Ohio . . *Tudor Arms Hotel, Cleveland. J. A. Mueller, manager, grinding laboratory, bonded abrasives division, The Carborundum Co., "Save on Snagging and Cut-Off."*

8-9 . . Eastern Canada, Ontario . . *Mt. Royal Hotel, Montreal. All-Canadian Regional Foundry Conference.*

9 . . Philadelphia . . *Engineers Club, Philadelphia. Howard Wilder, assistant manager, sales division, Vanadium Corp. of America, "Cupola Practice."*

12 . . Timberline . . *Oxford Hotel, Denver. Frank Scaggs, Oklahoma Steel Castings Co., "CO_2 Process."*

16 . . Birmingham . . *Tutwiler Hotel. Ferrous section: D Section meetings: ferrous, D. E. Krause, technical director, Gray Iron Research Institute, "Elements of Good Foundry Metallurgy;" non-ferous section, B. N. Ames, president, Columbian Bronze Corp., "Metallurgy in the Brass Foundry."*

21 . . Central Michigan . . *Hart Hotel, Battle Creek. Roy Carver, president, Carver Products Co., "CO_2 Process."*

29-30 . . Central Michigan, Detroit, Saginaw Valley, Michigan State University, University of Michigan . . *University of Michigan, Ann Arbor. Michigan Regional Foundry Conference.*

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CIRCLE NO. 167, PAGE 21-22

Training Future Foundrymen in PORTLAND

BILL WALKINS / *Editor, ESCO Ladle, Electric Steel Foundry Co., Portland*

Football games and pep rallies have ushered in the new school year and for 1600 fortunate young men it has meant the resumption of technical studies at Portland, Oregon's Polytechnic School.

These students are fortunate to have the opportunity to attend one of the finest technical schools in the U. S. and the only school of its type west of Chicago. Benson Polytechnic School, in addition to specialized training in many trades, offers a pre-engineering course where the shop courses often required of college engineering students—machine shop, welding, patternmaking and foundry—are offered. These courses are then waived in college.

Benson, established in 1908 as the Portland School of Trades, bears the name of a Portland pioneer, Simon Benson, who donated $100,000 to help erect the school on its present site. Benson draws its student population—1600 students, all boys—on a city wide basis. Each student is given the best technical training possible while receiving instruction in the usual academic subjects. Benson is fully accredited and graduates are eligible to continue their education in engineering and other fields.

The school serves three types of students: 1. Boys intending to go on to college. 2. Boys who do not intend to go to college and want to learn a trade. 3. Boys who are not certain about their future but who are interested in furthering their knowledge and skill.

Dr. Leon P. Minear, former president of Stockton Junior College in California, heads a faculty of 60. Birger Arnbom is patternmaker instructor and chairman of the placement committee. Harvey Summers is teaching foundry subjects. Mr. Summers attended the seminar for foundry instructors at the Kellogg Center in East Lansing, Michigan, under auspices of Oregon Chapter, AFS.

Pictures of the foundry operation were taken during the school's spring open house. Over 10,000 people paid fifty cents each for a guided tour of the school. The money will be used by students to finance extra-curricular projects.

How many other cities can show $5,000 worth of such interest?

Future foundrymen show their skill at operating a jolt-squeeze molding machine in school shop.

Teenagers with skillful and well-trained hands created the patterns in this extensive display.

Iron and crucible metal castings are typical of the work produced in the Benson Tech foundry lab.

Spectators are: Birger Arnbom, Dave Emsley, Bob Burns, Phil Laugen, Fred Menzel, Harry Czyzewski.

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Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi; Price: $81.65 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

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CIRCLE NO. 169, PAGE 21-22

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CIRCLE NO. 170, PAGE 21-22

obituaries

Robert E. Belt, 75, secretary-treasurer of Malleable Founders' Society from 1920 to 1946, died July 24 at Lima, Ohio. Since his retirement from the society, Mr. Belt had continued his interest as vice president of Columbus Conveyor Co.

Mr. Belt prepared cost accounting manuals for the malleable casting industry and wrote the book *Foundry Cost Accounting.*

Surviving are a daughter, Dr. Margaret Belt Busche of Lima, Ohio, three grandchildren, and two sisters. Mr. Belt was preceded in death three years ago by his wife, Jessie Rodgers Belt.

Martin A. Dooley, 67, a vice-president and secretary of the Sterling Wheelbarrow Co., West Allis, Wis., died August 20 in Paris, France, of a heart attack. He had been traveling through Europe with his son, Father John Dooley.

Mr. Dooley had been with Sterling for 33 years and was a director of the firm. He was also a director of the Loran foundry of West Allis.

Surviving are a son and a daughter.

Robert Boyd, 36, who operated the Boyd Pattern Shop, Marshall, Mich., died August 21 following an attack of amoebic dysentery.

Mr. Boyd was educated at Michigan State College and then entered the Army. He saw extended service in both the Pacific and European theaters during World War II and was discharged as a captain. After the war he served in the Federal Bureau of Investigation for two years.

He is survived by his parents and by his brother, Dave.

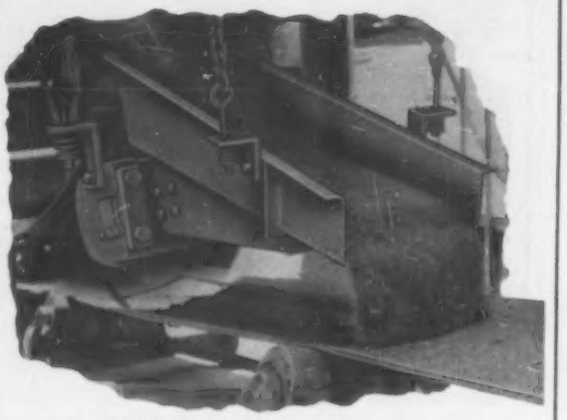
Gerald Frink, president and general manager of the Washington Iron Works, Seattle, Wash., died July 10.

Rocco J. Accetta, 48, passed away July 11. He was treasurer of the Whitehead Brass Foundry, Inc., Brooklyn, N.Y.

Gottlieb Loesel, 56, a partner in the Albra Metal Foundry Co., Long Island City, N.Y., died July 16.

Death took two veteran employees of the Lunkenheimer Co., Cincinnati. **Arthur F. Schmidt,** 62, director of purchasing, died July 24. And was

Controlled Feeding Means Low Cost Handling Of Bulk Materials



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HOPPER LEVEL SWITCHES

For automatically maintaining the desired maximum or minimum level of materials in bins or hoppers.

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CIRCLE NO. 171, PAGE 21-22

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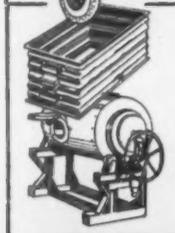

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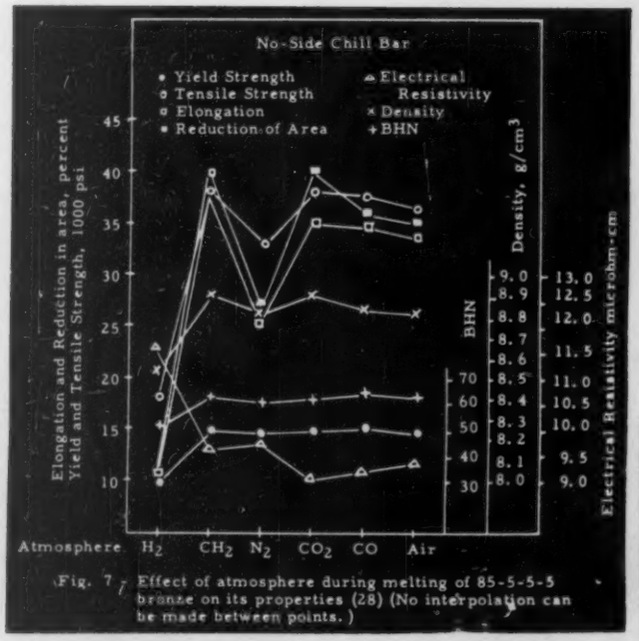

Fig. 7 — Effect of atmosphere during melting of 85-5-5-5 bronze on its properties (28) (No interpolation can be made between points.)

21 pp. 8 x 11 Paper Bound 10 Illustrations-Bibliography

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MELT QUALITY AND PRESSURE TIGHTNESS OF COPPER-BASE ALLOYS

Sponsored at Battelle Memorial Institute under supervision of the AFS Brass and Bronze Division's Research Committee, this survey traces factors affecting melting quality and pressure tightness of copper-base alloys, especially red brass. Causes of unsoundness and methods available to avoid gassing are concisely covered. Suggestions on how to obtain high quality and pressure tight castings are included, as is a list summarizing recommended good foundry practice. This booklet is an invaluable reference for foundrymen and metallurgists engaged in the production of copper-base alloys castings.

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followed on July 25 by his associate, **Harry A. Fox**, 64, a buyer for the purchasing division.

Arthur J. Boyer, 67, Philadelphia representative for E. F. Houghton & Co., died at his home August 20 after an illness of several months.

Mr. Boyer was an active member of ASM, American Society of Lubrication Engineers, Germantown Cricket Club, and was past commander of the Ocean City Yacht Club.

His wife, Pauline M.; two daughters; a sister; and three grandsons survive.

John J. Cleary, 66, vice-president, Sand Products Corp., Cleveland, passed away June 14 after being ill for several months. He was a member of the American Foundrymen's Society and of the Old Timers Group of the Northeastern Ohio Chapter.

August N. Farmer, 84, treasurer, Sand Products Corp., Cleveland, passed away June 23.

Electrolytic Metal Cutting

A process for the electrolytic cutting of metals with clean straight edges, free of mechanically imposed stresses and with no metal lost by dust, shavings or metal burned away has been disclosed by the Atomic Energy Commission with the release of patents available for industry use.

The patent is applicable to metals subject to electrolytic attack. Its apparatus consists of a tank containing the metal to be cut and mounted so that it rotates, the electrolyte, the cutting arm made of a central cutting electrode, two exterior robber electrodes separated by insulators, a means to adjust the cutting arm, circuitry to impress a potential between the cutting electrode and the robber electrodes, and a nozzle directing a flow of electrode against the cutting arm.

Patent No. 2,739,935 was issued March 27, 1956 to G. L. Kehl and I. Moch, Jr.

Now Where Was That?

■ You will have no trouble locating articles in back issues if you write for the index to 1955 issues of MODERN CASTINGS.

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For Sale, Help Wanted, Personals, Engineering Service, etc., set solid . . 25c per word, 30 words ($7.50) minimum, prepaid.

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FOUNDRY SUPERINTENDENT Medium size production jobbing gray iron foundry in Southern Ohio needs qualified practical foundryman to take complete charge of all foundry operations. Give full particulars in first letter including age, height, weight, experience, education, salary requirements and references. **Box C175, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines.**

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ME degree or equivalent. Jobbing or production foundry experience. Challenging assignments, advancement opportunities, good salary and benefits. Location—New York State. Resume requested. **Box C173, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

CORE ROOM FOREMAN For large alloy foundry in Middlewest. Must be thoroughly experienced. Send complete resume to **Box C179, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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Chief Metallurgist of executive caliber by long established large ferrous foundry in Chicago-Milwaukee area. Prefer man of medium age, grounded in ferrous castings with administrative potential. Compatible circumstances and good opportunity. State salary. Will consider confidential. Our employees know of this advertisement. Please write **Box C177 MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY TECHNICIAN OR QUALITY CONTROL ENGINEERING ASSISTANT

Mechanized gray iron foundry in Ohio producing quality engineering jobbing castings. Applicant should have some technical background, training or experience in one or more of the following fields—Metallurgy, Cupola Control, Sand Control, Gating and Risering. This position will offer many opportunities in increasing efficiency and control on all foundry operations including practical research, development and application on new foundry processes such as shell process and CO_2 process. Earnings will be dependent on qualifications and ability. **Box C160, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

CLEANING ROOM FOREMAN For large alloy foundry in Middlewest. Must be experienced. Send complete resume to **Box C180, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY FOREMAN Large alloy foundry in Middlewest desires thoroughly experienced Foundry Foreman. Send Complete resume to **Box C181, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY FOREMAN For Southern Ohio gray iron foundry employing 90 men on production jobbing. Excellent opportunity for ambitious young man to supervise molding and coremaking. Send complete details including age, experience, salary desired, references, weight and height. **C176, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines.**

PRODUCTION MANAGER Large sized alloy foundry in Middlewest desires Production Manager. Must be thoroughly experienced. Send complete resume to **Box C178, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

POSITIONS WANTED

DIRECTOR OF METALLURGICAL RESEARCH LABORATORY, Ph. D., 33, ten years experience in casting research and development. Experienced in setting up and carrying out an effective research program. Prefer west coast. **Box C182, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY SUPERINTENDENT WANTED

This is an unusual opportunity for growth which must be filled with outside magnesium foundry experience, and we will consider only well-qualified men. You must be capable of commanding an excellent salary (open to negotiation), based on your record. This is a modern magnesium sand foundry employing the latest methods of producing aircraft quality castings. It is located in a large Midwestern city, yet it is conveniently situated near new suburban communities. We will require full details in your reply. A personal interview will be arranged, at your convenience and transportation will be paid. Your reply will be completely confidential. All plant personnel know of this advertisement. **Address Box C183, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY ENGINEER

needed for modern high alloy stainless facility. $8,000 to $12,000 for a qualified person to develop operational sequences, prepare specifications and establish rigid quality controls. Fringe benefits equal to the best in the field. Job located in Middle Atlantic States. Include present salary, education and work experience in resume. **Box C172, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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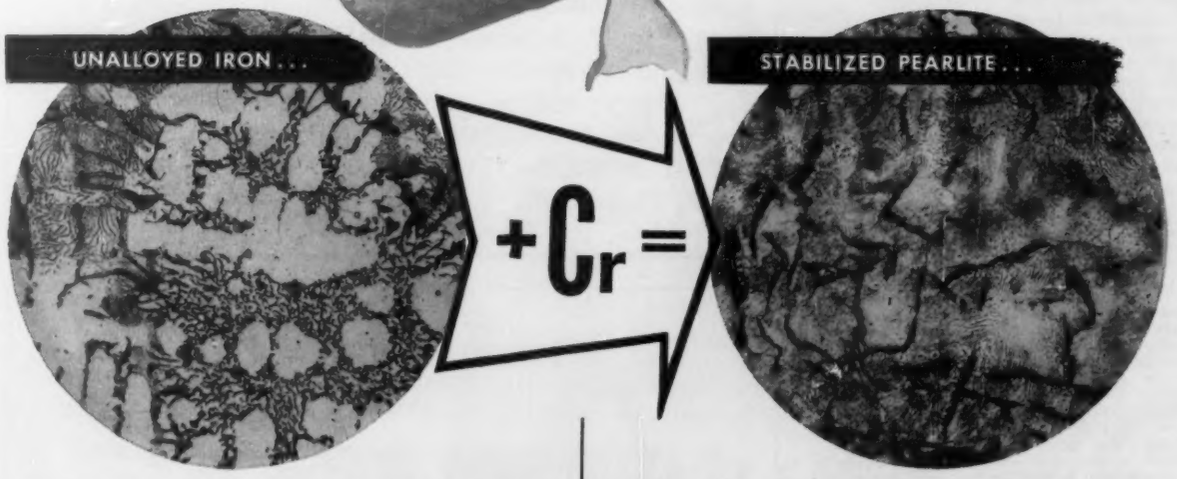

Figure 1. This micrograph (nital etch x 250) shows a critical section in the bore of an automotive cylinder. The section is made of unalloyed iron containing 3.24 per cent carbon and 2.12 per cent silicon. Note the large white areas of ferrite which make the cylinder soft and subject to failure by wear and scuffing.

Figure 2. Here is the same location in a similar cylinder made of chromium iron. The iron contained 3.24 per cent carbon, 2.45 per cent silicon, and 0.51 per cent chromium. You can see that the addition of chromium has produced a fine-grained pearlitic structure which is resistant to wear and heat.

Today, high-quality iron castings must meet specifications calling for specific microstructures, especially in critical sections where failure is most likely to occur. For the foundryman who must guarantee a pearlitic structure in castings subject to wear, heat, and abrasion, chromium is an indispensable alloying element.

Unalloyed iron may show wide variations in microstructure in the same casting, especially in sections subject to rapid cooling. These sections will usually contain large quantities of ferrite, as shown in Fig. 1. Addition of as little as 0.25 to 0.50 per cent chromium, however, will prevent the formation of ferrite, giving a stable pearlitic structure, as shown in Fig. 2. These stabilized chromium irons are widely-used in castings for heavy-duty automotive engines.

ELECTROMET produces a complete line of chromium alloys for use in structure control of cast iron. For ladle additions, ELECTROMET makes several grades of ferrochrome and ferrosilicon-chrome. When chromium is added to the cupola, foundrymen may use "EM" chromium briquets. For complete information about these chromium alloys, as well as technical assistance in their use, contact your nearest ELECTROMET office.

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Carbide Cermets Studied

High temperature-resistant materials research sponsored by the Air Force has included studies of carbide cermet and oxide type ceramic bodies and an investigation of thermal shock. Results are contained in a 97-page report, *Refractory Materials for Use in High Temperature Areas of Aircraft*, which may be obtained from OTS, U. S. Department of Commerce, Washington 25, price $2.50. Oxide-type ceramic bodies were submitted to tests intended to improve the properties of aluminum titanate bodies.

NEW PRODUCT IDEAS FOR THE CO_2 PROCESS

A number of proven products for the CO_2 process, that will improve cores and molds, cut costs and promote casting quality are now being manufactured by Stevens.

If you are now using, or are interested in, the latest foundry development, the CO_2 (carbon dioxide) process, write today for the new Stevens Technical Bulletin FA-130,

"STEVENS PRODUCTS FOR THE CO_2 PROCESS."

This bulletin gives complete information on the subject of release agents, core pastes, mudding compounds, core and mold coatings, collapsibility additives and binders for the CO_2 process. Write *FREDERIC B. STEVENS, INC., 1804 Eighteenth Street, Detroit 16, Michigan.*

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